The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

NOVEMBER 1937

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The MONTHLY REVIEW

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Report *of* Conference

Supplemental Exposure Tests of Plating, Principally on Non-Ferrous Metals.

NATIONAL BUREAU OF STANDARDS,
Washington, D. C.
October 6, 1937

The purpose of this conference was to secure information and recommendations regarding the scope and the methods to be used in additional exposure tests. Over 40 persons were present, including many members of the American Electroplaters' Society and the American Society for Testing Materials, and representatives of firms engaged in plating and in the plating supply business.

In order to clarify the various activities related to electroplating, a list of the committees directing such projects was distributed. The status of the exposure tests now in progress was then explained.

On account of the increasing commercial application of bright nickel solutions, serious consideration was given to their inclusion in the new exposure tests. It was emphasized that the primary purpose of any such exposure tests would be to determine whether in general, deposits from bright nickel solutions are equal, inferior or superior to ordinary nickel deposits of the same thickness; and not whether one of the bright nickel solutions is better than the others. In view of these facts, it was recommended that each proprietor of such solutions as are in extensive use, be invited to supply a quantity of his solution, and to advise regarding its satisfactory operation at the National Bureau of Standards. The specimens thus produced, from for example four bright nickel solutions, will all be marked alike, and will not be distinguishable from each other. The composite results obtained from exposures of these specimens will then be taken to represent the average performance of the bright nickel solutions in present use.

It was recommended that these bright nickel coatings and also regular nickel coatings be applied in appropriate thicknesses to steel, brass, and zinc base die-castings.

It was agreed that some of the zinc base die-castings should be plated in commercial plants. If proprietary bright nickel solutions are there in use, they will be employed, but without reference to the name of the solution.

It was recommended that most of the tests on brass be on rolled high brass, and those on zinc be on XXIII alloy. On brass, additional thicknesses of nickel and of chromium were proposed. It was suggested that some of the die-castings be plated without polishing prior to plating, in order to determine the effect of polishing the base metal. The use of the Rochelle salt-cyanide copper bath was recommended for die-castings.

In a discussion of the sites for the exposure tests it was pointed out that in evaluating the results, attention should be called to any marked differences in behavior in different locations, and not simply to the average scores.

In view of the extreme severity and inaccessibility of the present site on Brunot's Island in Pittsburgh, it was recommended that steps be taken to secure a somewhat less severe and more accessible site, preferably in the Pittsburgh district.

The present system of rating was approved, but in addition it was suggested that on iron and steel, separate ratings be given for rust and for other defects. On non-ferrous metals, notes regarding the prevalence of specific defects were suggested to supplement the numerical ratings.

The present practice of cleaning a certain proportion of the specimens at long intervals was favored. The use of a thin grease film on a small proportion of the specimens in order to simulate the behavior of exposed parts to which grease or wax has been applied, was also sanctioned.

At a meeting of the Research Committee and the joint Committee, the above recommendations were unanimously approved and the preparation of a program incorporating these features was authorized. Every effort will be made to complete the plating of the new specimens in time to start the new exposure tests in the spring of 1938.

LIST OF PERSONS ATTENDING THE CONFERENCE

E. A. Anderson, New Jersey Zinc Co.
Oscar H. Bahr, Kohler Company.
W. E. Baulieu, Jr., Bridgeport Brass Co.
W. Blum, National Bureau of Standards.
Adolph Bregman, Metal Industry.
A. Brenner, National Bureau of Standards.
T. H. Chamberlain, New Haven Clock Co.
T. G. Coyle, United Chromium, Inc.
Jos. L. Downes, Remington Rand Co.
L. E. Eckelmann, Pyrene Mfg. Co.
James Fraser, Sanitary Brass Association.
John R. Freeman, Jr., American Brass Co.
E. Fritts, Ternstedt Mfg. Co.
A. K. Graham, A. K. Graham & Associates.

Carl E. Heussner, Chrysler Corporation.
R. E. Hicks, Yale and Towne Mfg. Co.
G. B. Hogaboom, Hanson-Van Winkle-Munning Co.
L. W. Hopkins, American Chain & Cable Co.
H. M. Johnquest, Bridgeport Brass Co.
W. J. R. Kennedy, American Electroplaters' Society.
C. Kasper, National Bureau of Standards.
B. H. McGar, Chase Brass & Copper Co.
R. J. McKay, International Nickel Company.
C. J. Mond, Sanitary Brass Association.
E. V. Mott, Western Union Telegraph Co.
W. A. Olson, National Bureau of Standards.
W. M. Phillips, General Motors Corporation.
P. R. Pine, Harshaw Chemical Co.
W. B. Price, Scovill Mfg. Co.
Bert Sage, A. S. Campbell Co.
C. H. Sample, Bell Telephone Co.
P. M. Savage, McGean Chemical Co.
Philip Sievering, Sievering, Inc.
T. F. Slattery, U. S. Bureau of Engraving & Printing.
L. N. Smith, Harshaw Chemical Co.
G. Soderberg, Udylite Company.
P. W. C. Strausser, American Electroplaters' Society.
M. R. Thompson, National Bureau of Standards.
Van Winkle Todd, Hanson-Van Winkle-Munning Co.
C. A. Vincent-Daviss, R & H Division, Dupont Company.
W. A. Wesley, International Nickel Company.
Louis Weissberg, L. Weissberg, Inc.
A. B. Wilson, Chevrolet Gear & Axle Co.
Max M. Wise, Parker-Wolverine Co.
C. M. Yerger, Hanson-Van Winkle-Munning Co.

MEMORANDUM ON COMMITTEES ENGAGED IN ACTIVITIES OF DIRECT INTEREST TO THE ELECTROPLATING INDUSTRY

October 1, 1937

I. Introduction

During the past several years, various projects have been conducted upon different phases of electroplating, frequently through the cooperation of two or more associations or institutions. In the latter cases, joint committees have been organized in order to provide adequate representation of the various agencies. For these committees to function most efficiently, it is desirable that all interested persons transmit to the chairman or to the other members, their suggestions and comments. This informal memorandum has been compiled by W. Blum to list the membership and principal activities of these committees, and to foster such cooperation. Corrections, or information regarding committees that have been overlooked, will be gladly received.

II. Research Committee, American Electroplaters' Society

1. *Functions*: To plan and conduct researches of interest to the electroplating industry, to cooperate in researches with other organizations concerned with electroplating, to raise

funds from manufacturers or other sources to be used in such researches, and to expend these funds for such activities.

2. *Personnel*:—

W. M. Phillips, Chairman, General Motors Corporation, Detroit, Michigan.
T. H. Chamberlain, Vice-Chairman, New Haven Clock Co., New Haven, Conn.
E. A. Anderson, New Jersey Zinc Co., Palmerton, Pa.
William Blum, National Bureau of Standards, Washington, D. C.
G. M. Cole, Delco-Remy Division, General Motors Corporation, Anderson, Indiana.
Jos. L. Downes, Remington-Rand, Inc., Middletown Plant, Middletown, Conn.
Albert Hirsch, 1945 W. Airdrie St., Philadelphia, Pa.
G. B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, N. J.
Carl E. Heussner, Chrysler Corporation, Detroit, Michigan.
B. H. McGar, Chase Brass & Copper Co., Waterbury, Conn.
Bert Sage, A. S. Campbell Co., East Boston, Mass.
P. M. Savage, McGean Chemical Co., Republic Building, Cleveland, Ohio.
Erwin Sohn, Standard Sanitary Mfg. Co., Louisville, Ky.
C. S. Tompkins, J. B. Ford Sales Co., Chicago, Ill.
W. A. Wesley, International Nickel Co., Bayonne, N. J.
A. B. Wilson, President (ex.off.), Chevrolet Gear & Axle Div., General Motors Corporation, Detroit, Michigan.
Wm. J. R. Kennedy, Secretary-Treasurer, (ex.off.), 90 Maynard St., Springfield, Mass.

III. Joint Committee of the American Electroplaters' Society, American Society for Testing Materials, and National Bureau of Standards on Exposure Tests of Plating on Nonferrous Metals.

1. *Functions*: This committee includes five representatives from the American Electroplaters' Society, five from the American Society for Testing Materials, and one from the National Bureau of Standards. Its duties include the detailed planning of the exposure tests now in progress (chiefly on non-ferrous metals, but including some steel specimens), inspection of the specimens, preparation and publication of reports, and the preparation of specifications for plating on non-ferrous metals based on the exposure tests and other available information.

2. *Personnel*:—

	Representing
William Blum, Chairman, National Bureau of Standards, Washington, D. C.	NBS
T. H. Chamberlain, New Haven Clock Co., New Haven, Conn.	AES
B. H. McGar, Chase Companies, Waterbury, Conn.	AES
C. F. Nixon, Ternstedt Div., General Motors Corporation, Detroit, Michigan.	AES
W. M. Phillips, General Motors Corp., Detroit, Michigan.	AES
W. A. Wesley, International Nickel Co., Bayonne, N. J.	AES
To be appointed.	ASTM, A-5
J. R. Freeman (Alternate A. W. Tracy), American Brass Co., Waterbury, Conn.	ASTM, B-3
Sam Tour, Lucius Pitkin, 47 Fulton St., New York City.	ASTM, B-3
J. C. Fox, Doehler Die Casting Co., Toledo, Ohio.	ASTM, B-6
Carl E. Heussner, Chrysler Corporation, Detroit, Michigan.	ASTM, B-6

IV. Joint Committee of the AES, ASTM, and NBS on Specifications for Electroplated Coatings on Steel.

1. *Functions*: This committee prepared the Tentative Specifications for Electrodeposited coatings of Zinc (A164-35T), cadmium (A165-35T), nickel and chromium (A166-35T) on steel, that were adopted by the AES and ASTM in June 1935. The committee is responsible for recommending any changes or additions that should be made to these specifications prior to their adoption as "Standards" of the ASTM and AES.

2. *Personnel*:—

	Representing
W. M. Phillips, Chairman, General Motors Corporation, Detroit, Michigan.	ASTM
William Blum, Secretary, National Bureau of Standards, Washington, D. C.	NBS
F. M. Crapo, Indiana Steel & Wire Co., Muncie, Ind.	ASTM
L. W. Hopkins, American Chain Co., Bridgeport, Conn.	ASTM
L. H. Winkler, Bethlehem Steel Co., Bethlehem, Pa.	ASTM
To be appointed.	ASTM
W. S. Barrows, 628 Dovercourt Rd., Toronto, Can.	AES
G. B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, N. J.	AES
A. Pearson, Western Electric Co., Chicago, Ill.	AES
O. J. Sizelove, 919 Chancellor Ave., Irvington, New Jersey.	AES

V. ASTM Committee on Methods of Testing Electroplated Coatings On Steel

1. *Functions*: This committee was appointed by Sub-Committee (Methods of Testing) VII of ASTM Committee A-5 (Corrosion of Iron and Steel). Its purpose is to prepare exact descriptions of approved methods for testing plated coatings on steel, with a view to their inclusion in the tentative specifications that have been or may be adopted for such coatings.

2. *Personnel*:—(One more to be appointed)

W. M. Phillips, Chairman, General Motors Corporation, Detroit, Michigan.
W. Blum, Secretary, National Bureau of Standards, Washington, D. C.
E. A. Anderson, New Jersey Zinc Co., Palmerton, Pa.
E. M. Baker, University of Michigan, Ann Arbor, Mich.
W. H. Graves (alternate J. Higgins), Packard Motor Car Co., Detroit, Michigan.
*G. B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, N. J.
L. H. Hopkins, American Chain Co., Bridgeport, Conn.
*G. Soderberg, Udylite Company, Detroit, Michigan.
E. S. Taylerson, American Sheet & Tin Plate Co., Pittsburgh, Pa.
*Sub-committee on Methods of Sampling.

VI. Sectional Committee on Specifications for Zinc Coating on Iron and Steel

1. *Functions*: This committee was appointed to carry out Project G 8 of the ASA (American Standards Association). Its "sponsor" is the ASTM. Its functions include the preparation

of specifications and tests for all kinds of zinc coatings on all types of iron and steel articles. It includes representatives of 32 associations or institutions, listed in the ASTM Year-Book.

2. *Personnel*:—

J. A. Capp, General Electric Co., Schenectady, N. Y.—Chairman.
A. B. Campbell, Edison Electric Institute, 420 Lexington Ave., New York City—Secretary.
G. B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, N. J.—Representing AES.

VII. American Standards Association

Sub-Committee to prepare safety code for sanitation in electroplating operations.

1. *Functions*: This committee was appointed to prepare a safety code for the electroplating industry with special reference to ventilation in chromium plating and other hazardous plating operations.

2. *Personnel*:—

J. J. Bloomfield, Chairman, U. S. Public Health Service, Washington, D. C.
Cyril Ainsworth, Secretary, American Standards Association, 29 West 39th St., New York City.
J. R. Allan, International Harvester Co., 606 South Michigan Ave., Chicago, Illinois.
William Blum, National Bureau of Standards, Washington, D. C.
J. M. Dalle Valle, U. S. Public Health Service, Washington, D. C.
S. W. Gurney, Liberty Mutual Insurance Co., Boston, Mass.
Carl E. Heussner, Chrysler Corporation, Detroit, Michigan.
Fred Sehl, Aetna Life Insurance Co., Hartford, Conn.

VIII. Electrochemical Society — Committee on Subjects for Research in Electrodeposition

1. *Functions*: This committee was recently appointed by the Electrodeposition Division of the Electrochemical Society to prepare a list of problems that may be suitable for research in industrial, educational and institutional laboratories.

2. *Personnel*:—

William Blum, Chairman, National Bureau of Standards, Washington, D. C.
Carl E. Heussner, Chrysler Corporation, Detroit, Michigan.
U. C. Tainton, 3100 Elm Avenue, Baltimore, Maryland.

RESEARCH COMMITTEE SUB GROUP APPOINTED

President A. B. Wilson and Mr. Wm. Phillips, Chairman of the Research Committee have announced the appointment of W. J. R. Kennedy, T. H. Chamberlain, Bert Sage, W. M. Phillips, as members of the above named committee. Their duties will be to handle the matter of the appropriation of funds, from the Research Fund to the necessary expenditures.

The appointment of such a committee for this purpose was suggested at the Research Committee Meeting in Washington, October 6.

Summary *of* Activities *on* Electrodeposition *at the* National Bureau *of* Standards[1]

June 1, 1936 to June 1, 1937

WILLIAM BLUM[2]

I. SCOPE OF ACTIVITIES

Before discussing specific projects upon which this section of the Bureau has been engaged during the past year, it may be of interest to outline those functions of the Bureau that find expression in the field of electrodeposition. The principal activities are as follows:

1. Researches upon general principles of electrodeposition.
2. Studies upon the quality and value of electroplated coatings and the development of specifications for use by the Government and Industry, including both manufacturers and consumers.
3. Investigation of methods of testing plated coatings and the materials and solutions used in plating.
4. Testing of electroplated metals such as hardware and plumbing fixtures that are purchased by the Federal Government upon specifications. (Tests are not made for the general public.)
5. The development of special processes or equipment required by other branches of the Government.
6. Furnishing information to the Government and to the public.

In all the above activities the Bureau cooperates with other Government agencies and with technical societies. At present the American Electro-Platers' Society is represented by a Research Associate, P. W. C. Strausser, in a study of the protective value of plated coatings.

At present the section includes five persons, in addition to the Research Associate, who are engaged in laboratory work. It is not possible with this staff to conduct extensive studies on all the above subjects, but some work has been done this year on each of these projects.

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[1] Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] Chemist, National Bureau of Standards.

II. SPECIFICATION AND TESTING

There was a considerable increase in the number of plumbing fixtures tested for use in Government buildings. These tests, together with the analysis of plating solutions used in Government plants, and examination of plated materials for the Federal Trade Commission, required practically the entire time of one chemist. Routine tests are of value not only in aiding the Government to secure materials of required quality, but also in enabling manufacturers to learn the adequacy (or inadequacy) of their present methods for controlling the thickness of deposits. Such knowledge may in turn lead to improvements in the quality of articles sold to the general public.

In general, the effort is made to have the Federal specifications consistent with the quality of commercial articles that are required to meet similar service. In this connection the requirements of the specifications adopted by the American Electro-Platers' Society and the American Society for Testing Materials, especially for zinc and cadmium coatings, have been incorporated in several Federal specifications, for example for turnbuckles, outlet boxes and conduit fittings, and are under consideration for other articles. It is hoped that from a thorough trial of these specifications by the Government and industry, their value and limitations will be ascertained.

III. INVESTIGATIONS

1. Exposure tests of plating on non-ferrous metals. The observations during one year's exposure will be reported in a separate paper. This investigation has required a large portion of the time of P. W. C. Strausser and W. Blum in connection with inspections, installations, compilation of data, and conferences with committees of the A. E. S. and A. S. T. M.

2. Laboratory tests on plated coatings. A separate report will be presented upon the studies made by P. W. C. Strausser on methods for testing the thickness, porosity and protective value of plated coatings on non-ferrous metals.

3. Magnetic method for measuring the thickness of nickel coatings on non-ferrous metals. A paper by A. Brenner on this subject that was published as Research Paper 994 in the Journal of Research of the NBS for May, 1937, will also be presented by him to this convention. It is hoped that this method, which

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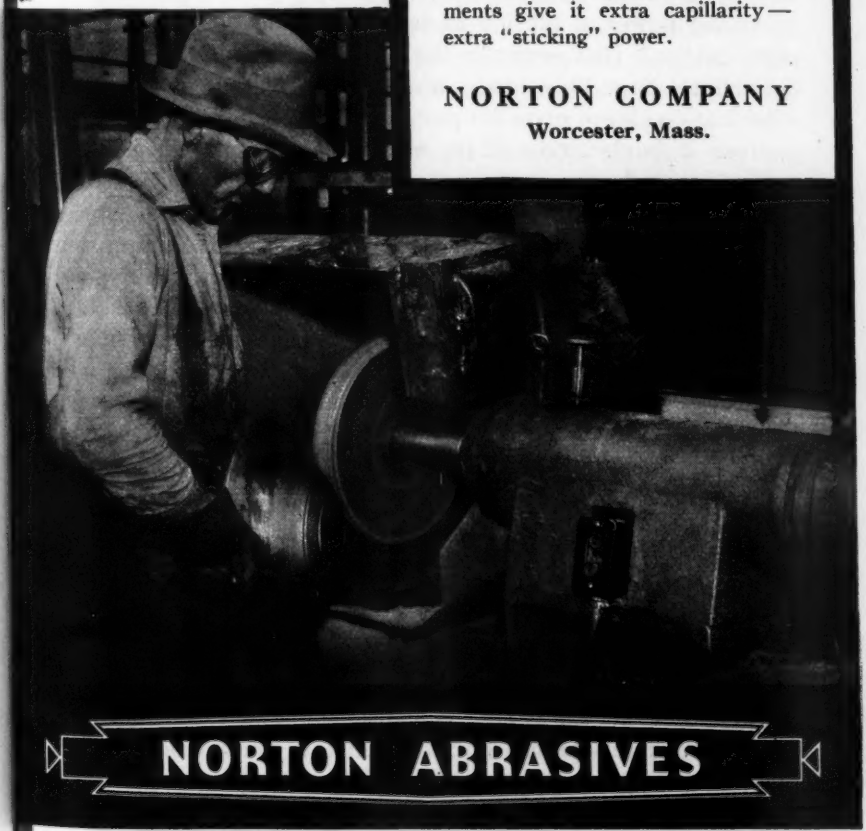

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is non-destructive, will prove useful in routine testing of plated articles such as plumbing fixtures and automobile hardware.

4. The constitution of copper cyanide solutions. Press of other work has prevented M. R. Thompson from making rapid progress on this investigation. The composition and metal-cyanide ratios of solutions saturated with cuprous cyanide have been determined. Some measurements have also been made of potentials and of heats of reaction, but it is not yet possible to decide definitely just what ions are present in these baths. A solution of this problem may lead to improvements in the operation and control of such baths, and will certainly contribute to a better understanding of all cyanide solutions.

5. Primary current distribution in electrodeposition. Most of the methods proposed for measuring and expressing the throwing power of plating baths involve the "primary current distribution," that exists in the absence of polarization. Very few efforts have been made, however, to measure this primary distribution except upon flat parallel plates, where it is practically uniform if the electrodes fill the entire cross section of the solution.

C. Kasper has started an investigation of this subject that will include a critical study of the very involved mathematical formulas for the distribution of electrical potential and current upon various geometrical shapes, both with and without polarization. It is hoped that on certain arrangements, such as eccentric cylinders and angular electrodes, it will be possible to experimentally confirm these computations, and thus determine their applicability to conditions that exist in electrodeposition. The results of such a study will probably be useful in designing the arrangement of anodes, cathodes, racks, and shields that will produce the most uniform plating. Such uniformity is especially desirable in plating to meet specifications for a minimum thickness of deposit.

IV. CONTACT WITH THE PUBLIC

The practical value of research work in any field is determined largely by the extent to which persons engaged in that field learn and make use of the conclusions. The results of completed investigations are published in the Journal of Research of the NBS, and the separate papers can be purchased at nominal prices from the Superintendent of Documents. The

demand for the publications on plating, including especially Research Papers 712 and 724 on the protective value of nickel and chromium coatings; 867 on zinc and cadmium coatings, and 866 on the chord method, has been very gratifying.

About 100 explicit inquiries on plating problems are received each month, and numerous persons visit the Bureau to obtain information. Addresses have been made to several branches of the A. E. S. and other technical societies. It is encouraging to note that many of these were joint meetings, in which chemists, engineers and platers were represented. Association of these groups fosters progress.

The official funds available for travel are sufficient only for attendance at conventions of organizations directly associated with the work, and for meeting the needs of the Government. Much of the expense of travel required for installation and inspection of exposure tests has been paid by the A. E. S. The expense involved in addressing local meetings is usually borne by the organizations involved.

It is expected that most of the subjects discussed in this report will be included in work to be conducted during the coming year. Progress will be facilitated by a continuation of the cordial cooperation that has been received from persons, firms and organizations interested in this field.

PROGRESS REPORT
JOINT COMMITTEE ON EXPOSURE TESTS OF PLATED COATINGS ON NON-FERRUS METALS

I. INTRODUCTION

Exposure tests of plated coatings on copper, brass, zinc, and die-castings, and also a few new sets on steel and iron, were started in the spring of 1936. The results to date with the plated steel are consistent with the first series and do not warrant any detailed consideration at this time. This report is therefore confined to plating on non-ferrous metals on which most of the coatings are thinner than those on the steel; in accordance with commercial practice.

II. RESULTS OF INSPECTIONS

During the 9 months exposure, 4 formal inspections were made at Key West, and 3 at each other location. At the first inspection no numerical ratings were applied by the inspectors,

who merely recorded the nature and relative extent of the defects observed. Study of these reports showed that the data could be at least roughly correlated with the same numerical scale as was used for iron and steel in the previous and present exposure tests. The only essential difference is that on iron and steel the rating refers solely to rust, while on the non-ferrous metals equal weight is given to any visible defects, including white or dark spots, tarnish, blistering, and cracking.

The use of this scale in the subsequent inspections has yielded fairly consistent, though not entirely concordant results. For example, at a given inspection one or more inspectors may record lower ratings than do others for the same specimens, but in general all inspectors place the sets in the same order. The arithmetical average of all the ratings was taken for that set, and as there were five or more persons at almost every inspection, the average results were more consistent than were the individual ratings. It is believed that more discussion of the ratings at each inspection after they have been made independently will assist the inspectors to "calibrate" their rating scales.

One criterion of the validity of the average ratings is whether they decrease consistently at successive inspections, that is, correspond to increasing failure. A regular decrease in rating was observed in practically all the inspections. In those few cases in which the rating increased at one inspection, the discrepancy was less than one unit. This consistency of ratings with time shows that the ratings are not haphazard, and that they have some quantitative value.

Another criterion of validity is whether the ratings place the sets in a regular order with respect to some pronounced variable such as thickness. To test this point, the average ratings in six locations after one year's exposure were compiled and were plotted in suitable curves. These values represent the composite performance in two industrial locations (New York and Pittsburgh), where corrosion was very severe; in two marine locations (Sandy Hook and Key West), where the corrosion was moderate; and two mild locations (State College and Washington), where only very thin or poor coatings showed appreciable failure.

The differences in rating of similar coatings of the same thickness, that were produced under slightly different conditions or

on different base metals of the same group (copper bearing or zinc-bearing) were too small to justify conclusions at this time. Further observations, including supplemental tests, will be required before publishing conclusions regarding such variables.

Certain of the results were, however, so consistent that they appear to warrant the following, purely tentative conclusions:

1. Chromium coatings with no undercoat of nickel furnish very little protection.

2. On all base metals, the protective value increases with the thickness of nickel.

3. Relatively thin nickel coatings furnish more protection on copper and copper alloys than on zinc or steel. (This is consistent with the customary practice of using less nickel on brass than on zinc or steel.)

4. About the same protective action is furnished by a given thickness of nickel on zinc and on steel.

The average ratings for a given thickness of steel in the present tests were concordant with those at the end of one year's exposure in the tests started in 1932.

III. USE OF COLOR PHOTOGRAPHY IN INSPECTIONS

In an effort to secure a permanent, objective record of the tarnish and corrosion, C. A. Vincent-Daviss took color photographs of many of the specimens in different locations. The results thus far obtained are only exploratory, as it was necessary to experiment with different types of film, illumination and exposure. The resultant pictures are a great improvement over black and white photography, as they record plainly the difference, e. g., between superficial stains and actual corroded areas. They do not, however, reproduce closely the visual appearance of bright surfaces, which, in the pictures, have the color of the sky or other surface reflected in them. Further efforts will be made to improve and standardize the procedure so as to permit valid comparisons.

IV. EFFECTS OF CLEANING

At the end of one year's exposure, one specimen (C) of each set was cleaned with tripoli (or pumice) and water, in order to determine whether the coating and base metal had been seriously damaged by the tarnish and corrosion. This cleaning made an

improvement in the appearance of all the coatings. This improvement was more marked on plated brass than on plated zinc or steel. This indicates that the observed discoloration was more superficial, that is, there is less actual corrosion of the brass than of the zinc or steel.

V. EFFECT OF GREASE FILMS

Preliminary tests showed that if a very thin film of grease or wax is applied to the plated surfaces (as is customary on automobiles) it retards corrosion and facilitates subsequent cleaning. In April and May, two new specimens of most of the sets were exposed and were treated with a dilute solution of petrolatum in mineral spirits. This leaves a grease film about 0.000005 inch thick. These specimens will be inspected and wiped, and new grease films applied at the regular inspections.

VI. SUPPLEMENTAL TESTS

At a conference of the A. E. S. Research Committee and the Joint Committee in Chicago on March 1, 1937, it was recommended that some additional sets be plated and exposed in the near future. These will serve to confirm or extend the observations in the first exposures, and will give an opportunity to try different methods of preparation, especially of die-castings. Valuable suggestions have been received from various persons, and will be incorporated in the supplemental program. It is planned to expose the new specimens in the spring of 1938.

Respectfully, (Signed) W. Blum, Chairman, Joint Committee on Exposure Tests of Plating on Non-Ferrous Metals, A. E. S. & A. S. T. M.

THE USE OF COLOR PHOTOGRAPHY FOR RECORDING THE RESULTS OF EXPOSURE TESTS[1]

C. A. VINCENT-DAVISS[2] and W. BLUM[3]

I. INTRODUCTION

During the past several years, exposure tests of electroplated coatings on both steel and non-ferrous metals have been conducted jointly by the American Electro-Platers' Society,

[1]Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.
[2]R. & H. Division, Dupont de Nemours Co.
[3]Chemist, National Bureau of Standards.

American Society for Testing Materials, and National Bureau of Standards. The results have been expressed in terms of numerical ratings assigned by members and associates of the Inspection Committee. While these results have been surprisingly concordant and consistent, they do not furnish a permanent objective record of the appearance. Such a record is especially desirable in comparing results of different observers in different locations or at different times.

The purpose of this investigation was to determine whether such a record can be obtained by means of color photography. It will be shown, in the accompanying slides, that the results are sufficiently promising to warrant further efforts in this direction. At best, this method will serve simply as a new tool to supplement, but not to replace, visual evaluations.

II. TECHNIQUE

The purpose of these tests was to obtain such a photographic record of the appearance as will reproduce the mental image retained by the eye and mind of an observer. This is rendered difficult by the fact that an observer unconsciously evaluates or discounts certain features which the camera records impersonally.

A. Types of Photographic Film:

Pictures were made with both Kodachrome and Dufay films. Briefly, the former type depends upon the successive development and dyeing of super-posed layers of suitable emulsions. The Dufay film depends upon the passage of the light through fine colored lines ruled on the film. Practically it was found that the latter type gives more satisfactory records for this purpose. The Dufay pictures were found preferable, even though the final colors are not always as pleasing as those with the Kodachrome.

In the initial photographs, a moving picture camera was employed with fair success. However, the specimens are stationary and it was found that still pictures are equally faithful in color, less expensive and more convenient to study and exhibit. Hence, most of the later pictures were taken with a still camera, on films of a size suitable for mounting on lantern slides.

In all cases, the films were developed by their respective manufacturers.

B. Lighting and Exposure:

The photographs were usually taken on the days selected for the inspections, and natural lighting was employed. This varied at different times and in different places from very bright sunshine to cloudy or even rainy weather. In all cases the time of exposure was derived from readings on a Weston exposure meter. In order to eliminate variations in lighting, one set of pictures was made at night with controlled artificial illumination.

III. RESULTS

In general the pictures were found to yield a satisfactory record of the color and appearance of any defects observable to the eye, such as cracks, blisters, peeling, tarnish, and localized corrosion. This record is far more valuable than that obtained by black-and-white photography, which does not discriminate sharply between different colors or different types of failure.

The chief limitation of the procedures used is that mirror-bright surfaces (such as chromium plated finishes) were recorded with the color of whatever was reflected in them, for example a blue sky, clouds, or surrounding buildings. In visual observation a mental discount of such features is apparently made automatically, partly as a result of viewing the specimens from different angles. Consequently the color photographs, however faithful they may be, do not give the same impression as is obtained visually.

An effort was made to eliminate these chance reflections by photographing the specimens at night with controlled artificial illumination. Under such conditions the defects showed up in practically the same form and color as in the daylight pictures, but the bright surfaces appeared black. Here again, although the photographs reproduced the actual appearance at night, and may be very useful for recording the extent and progress of corrosion, they do not appear "natural."

IV. FUTURE PLANS

The simplest way to avoid direct reflections is to surround the specimens during their photographing with a translucent material such as tracing cloth or other suitable fabric. Such experiments are planned for the near future. Another possible

means of improvement is the use of moving pictures taken at different angles in order to more nearly reproduce the practice of an observer.

One possible advantageous procedure is to take the photographs with polarized light, which may reduce or eliminate undesirable reflections. Such studies are also planned.

We desire to express our appreciation for the cooperation received from members of the Joint Inspection Committee, and from D. R. Kellogg, who took some of the photographs in Pittsburgh.

CHAIRMAN HOGABOOM: I think the Society is very much indebted to Mr. Vincent-Daviss for his patience and ingenuity in bringing such expertly colored pictures to our attention. They certainly will form a record so that platers, twenty-five years hence, can see just as we are seeing today what has happened during twenty-five years at these different conventions. These papers are now open for discussion. Dr. Blum will be pleased to answer any questions that may be asked.

MR. JOHN FORBATH (New York City): I did not hear you mention, in your lecture, anything about steel bases, nor if there were any coatings other than nickel.

DR. BLUM: You will notice that in these coatings we have copper and nickel and chromium or combinations of these on steel as well as on the other metals.

MR. C. W. SMITH (Grand Rapids, Michigan): You mentioned copper on die-castings under nickel. Did you find that the pH had any effect?

DR. BLUM: We did not investigate the pH. As a matter of fact, the tendency toward blistering of coatings on die-castings that contain a layer of copper was much greater with thin coatings, say with a total of less than half a thousandths of an inch than it was with a total of one thousandths or two thousandths of an inch. As I stated before, we just used one procedure, one method of cleaning and preparation, pickling, and so forth. We hope by making tests on other metals to find out whether we may be able to overcome that tendency.

CHAIRMAN HOGABOOM: I should like to mention something which I am anticipating stating in my report of the pH of alkaline plating solutions. Dr. Springer, of the Langhein-Pfanhauser-Wercke Co., found he obtained blistering at certain

pH's of copper, while in other pH's he did not obtain blistering on metals other than zinc.

DR. BLUM: We control those solutions so far as the metal content and cyanide are concerned. I think it would be well worth while to control the pH.

CHAIRMAN HOGABOOM: Is there any further discussion?

I think we owe a debt to Dr. Blum for this paper, and I think we also owe, as I stated in the beginning, a debt to Mr. Vincent-Daviss. I am going to ask Mr. Vincent-Daviss to rise so that we may thank him for his work. Mr. Vincent-Daviss. (Applause)

LABORATORY TESTS OF ELECTROPLATED COATINGS ON NON-FERROUS METALS[1]

by P. W. C. STRAUSSER[2]

I. INTRODUCTION

During the past year, exposure tests of plated coatings on copper, brass, zinc, and zinc-base die-castings have been conducted at six locations. These tests are still in progress and some time will elapse before detailed conclusions can be drawn regarding the relative protective value of the various coatings.

In the meantime a study was conducted to determine what laboratory methods might be used to define the quality of the coatings, for example in specifications. This report is a summary of the results obtained with various methods of test. Pending the completion of the exposure tests, it is not possible to compare these results quantitatively with the behavior of the coatings in service. Such a comparison will be made in a subsequent publication.

As general experience, including that with plated coatings on iron and steel, indicates that the protective value of plated coatings is determined principally by their thickness and lack of porosity, methods for measuring these properties were studied, with special reference to nickel and chromium coatings.

II. THICKNESS

A. Average Thickness:

Although modern plating specifications generally prescribe the minimum thickness of the coating at significant points, some

[1]Publication approved by the Director of the National Bureau of Standards, U. S. Department of Commerce.

[2]Research Associate of the American Electro-Platers' Society at the National Bureau of Standards.

specifications still refer to the average thickness. This is usually determined by "stripping," that is, by dissolving the coating from a surface of known area. If this is accomplished without any appreciable attack of the base metal, the loss in weight represents the weight of the coating, from which the average thickness may be computed. If some of the base metal is dissolved, it is necessary to determine the amount of the metal coating by an analysis of the resultant solution.

The study of stripping methods was devoted to the definition of conditions that will yield, by loss in weight, an accuracy of at least 10 per cent on deposits of the customary thickness, which accuracy is sufficient for most commercial testing. Specimens having deposits of known weight were used in the tests. Unless otherwise stated, observance of the following conditions will yield results having the above accuracy.

(1) *Chromium Coatings*:

(a) From Nickel. Chromium may be dissolved from nickel by immersion in dilute hydrochloric acid (1 volume of concentrated acid to 9 of water) at about 70° C (158° F.) If the underlying nickel layer is on brass, the latter is not appreciably attacked, even when the nickel is porous. If, however, the nickel is over zinc, and is thin and porous, some zinc may be dissolved during solution of the chromium. For such conditions, it is better to dissolve the chromium by making the specimen anodic in a solution containing 100 g/l of sodium carbonate (Na_2CO_3). A current density of about 2 amp/dm^2 (19 amp/ft^2) is used, which requires a potential of about 4 volts.

(b) From Brass. Immersion in warm dilute hydrochloric acid is satisfactory.

(c) From Zinc. Anodic treatment in a solution containing 30 g/l of sodium sulphide ($Na_2S.9H_2O$) and 20 g/l of sodium hydroxide (NaOH) is suitable. A current density of about 2 amp/dm^2 (19 amp/ft^2) is used, which requires a potential of about 3 volts.

(2) *Nickel Coatings*:

(a) From Brass. When nickel-plated brass is made anodic in dilute hydrochloric acid (10 per cent by volume), the nickel is entirely removed, but a small amount of brass is also dissolved. It is therefore necessary to determine the nickel in the

resultant solution, for example by the dimethylglyoxime method. This procedure is prescribed in Federal Specifications for hardware and plumbing fixtures.

If the plated article is made anodic in 66 per cent sulphuric acid (sp.gr. 1.57), with a current density of about 2 amp/dm^2 (19 amp/ft^2) the nickel is removed without appreciable attack of the brass.

Nickel can be quantitatively stripped from brass by anodic treatment in a solution containing 100 g/l of sodium thiocyanate (NaCNS) and 100 g/l of sodium bisulphite ($NaHSO_3$). A current density of about 3 amp/dm^2 (28 amp/ft^2) is used, which requires a potential of about 3 volts. When all the nickel is dissolved, a thin black film, probably of copper sulphide, forms on the surface of the brass. This can be removed by light scrubbing, with no appreciable loss in weight of the brass. With repeated use, the solution tends to become alkaline and requires occasional small additions of bisulphite to keep it slightly acid.

(b) From Zinc. The articles are made anodic in a solution containing 66 per cent by weight of sulphuric acid (H_2SO_4) (sp.g. 1.57). A current density of 2 amp/dm^2 (19 amp/ft^2) is used, which requires a potential of about 1 volt.

(c) From Copper. If the nickel is deposited on copper or over a layer of copper on zinc, it may be removed by anodic treatment in 66 per cent sulphuric acid.

(3) *Copper Coatings*:

(a) From Zinc. Copper may be dissolved from zinc by anodic treatment in a solution containing 120 g/l of sodium sulphide ($Na_2S.9H_2O$) with a current density of about 2 amp/dm^2, which requires a potential of about 2 volts.

(b) From Nickel. Copper may also be dissolved from nickel by anodic treatment in sodium sulphide.

For convenience, the above methods are summarized in Table 1. (see page 826 for Table 1)

B. Local Thickness:

In order to determine the minimum thickness of a coating it must be possible to measure the thickness at any desired point. The most common method used for this purpose is the metallographic, which, with proper precautions, yields an accuracy

of about 5 per cent. No special study was made of the metallographic method, but it was employed to check the thickness of coatings on specimens used to standardize or test other methods of measuring thickness. For nickel, the most promising methods are the magnetic[3], to be described in a separate paper by A. Brenner, and the jet method, recently published by S. G. Clarke[4].

(1) *Preparation of Standards.* In order to standardize and test any method for measuring the local thickness of deposits, it is necessary to have coatings of known, uniform thickness. Such coatings were produced in the preparation of the specimens for exposure tests. The plating racks were designed so as to produce a nearly uniform coating over most of the area of each specimen, but with an intentionally thicker coating near the edges. Specimens plated at the same time as those used in exposure tests were employed for many of the following experiments, and for other tests single specimens were similarly plated. Metallographic and magnetic measurements of the nickel coatings showed that if a strip one half inch wide was cut from each edge of the 4 x 6-inch specimen, the thickness on the remainder was uniform within about 5 per cent. The average thickness on this center portion was computed from the difference between the total weight of the nickel coating and the weight of nickel found by analysis on the strips that were cut off.

(2) *Chemical Methods.*

(a) Jet Test for Nickel. This test is similar to the dropping test used for zinc and cadmium coatings, which was also devised by Clarke. However, instead of applying the solution in successive drops, it is delivered in the form of a fine continuous jet, which dissolves the coating on a very small area. The endpoint is defined by the exposure of the base metal or by the appearance of some characteristic color at the spot tested. As it is not practicable to detect the endpoint while the jet is running, it is necessary to stop the jet at intervals and examine the spot. Hence, the total time required is recorded with a "stop and go" watch instead of the ordinary stopwatch that is used for the dropping method.

[3]Brenner, A.—Research NBS 18, 565 (1937); (RP 994).
[4]J. Electrodepositors' Tech. Soc. Vol. 12, preprint, Oct. 1936.

TABLE 1
METHODS OF STRIPPING

No.	Coating Stripped Metal	Coating Intermediate	Base Metal	Reagent	Anode current density amp/dm²	Potential volts	Procedure
1	Cr	...	Brass	HCl, 10% by volume	...	...	Immersion
2	Cr	Ni	Zinc	HCl, 10% by volume	...	...	Immersion
3	Cr	Ni	Zinc	Na_2CO_3, 100 g/l	2	4	Anodic
4	Cr	...	Zinc	($Na_2S.9H_2O$, 30 g/l (NaOH, 20 g/l	2	3	Anodic
5	Ni	...	Brass	H_2SO_4, 66% by weight	2	2.5	Anodic
6	Ni	...	Brass	(NaCNs, 100 g/l ($NaHSO_3$, 100 g/l	3	3	Anodic
7	Ni	...	Zinc	H_2SO_4, 66% by weight	2	1	Anodic
8	Ni	Cu	Zinc	H_2SO_2 66% by weight	2	1	Anodic
9	Cu	...	Zinc	$Na_2S.9H_2O$, 120 g/l	2	2	Anodic
10	Cu	Ni	Zinc	$Na_2S.9H_2O$, 120 g/l	2	2	Anodic

The jet method is applicable to numerous metal deposits, but appears especially useful for nickel coatings, which dissolve very slowly if the same reagent is used in a dropping test. For testing nickel coatings Clarke recommends the following reagent:

Ferric chloride, $FeCl_3.6H_2O$	150 g/l
Copper sulphate, $CuSO_4.5H_2O$	100 g/l
Acetic acid (glacial) $HC_2H_3O_2$	250 ml/l

Tests by this method were made on nickel-plated copper, on which the endpoint is defined by the appearance of a copper-red spot. (Chromium coatings must first be removed, for example by solution in hydrochloric acid.) As the rate of solution is appreciably affected by changes in temperature, it is necessary to derive the thickness factor from a curve which gives the rates at different temperatures. Such curves were published in Clarke's paper.

It was found that the endpoint is sharp and reproducible within about 5 per cent on a given coating. With deposits produced from the bath used by Clarke, which contained nickel sulphate, potassium chloride, and boric acid, at a pH of 3.5, the average results agreed very closely with those reported by Clarke. However, with deposits from the bath used for the exposure specimens, which contained nickel sulphate, nickel chloride, and boric acid, at a pH of 5.3, the coatings dissolved about 25 per cent more rapidly than those of Clarke. Subsequent study showed that large variations in the pH of either type of bath produced appreciable changes in the rate of solution of the nickel. This rate also changed somewhat with the lapse of time after the nickel was deposited.

Such an effect of the conditions of deposition was not unexpected. In fact, Clarke reported that certain bright nickel deposits dissolved 80 per cent more rapidly than the regular nickel. This ratio was approximately confirmed with a commercial bright nickel coating produced in this country.

The net indication of these few tests was that the conditions used for depositing the nickel may change its rate of solution somewhat more than the ±15 per cent suggested by Clarke as the probable accuracy of this method. In a recent communication, Dr. Clarke stated that he had found that the rate of reaction of the test solution increases slowly with time. This fact may account for some of the above variations in our results. Dr. Clarke is making further studies on stabilizing his solution, the results of which will no doubt be published.

(b) Spot Test for Chromium. The most promising method for measuring the local thickness of chromium coatings is that in which one drop of concentrated hydrochloric acid (sp.g. 1.180) is applied to the surface, and the period from the beginning to the end of effervescence is noted with a stopwatch. This method has been extensively used in the automobile industry for several years, but at times different observers have failed to agree in their results.

In order to define more sharply the beginning and end of the reaction, two minor but apparently helpful modifications were developed. To confine the acid to a definite area and to prevent its gradual spread, with continued bubbling on the edges, a ring of melted wax is applied to the spot to be tested. This may be done on flat surfaces with the end of a glass tube about 1 cm (0.4 inch) in diameter; or on curved surfaces with a small brush.

At times, especially when the temperature is below 25° C (77°F), the chromium is passive, and does not start to dissolve as soon as the acid is applied. It was found that by touching the surface under the drop of acid with a fine nickel wire, gas evolution started instantly, thus rendering the initial timing more accurate.

When preliminary tests were made under these conditions at the prevailing room temperature (then about 28° C) (82° F) it was concluded that it required 10 ±1 seconds for each 0.00001 inch of chromium. It was then observed that this rate changed

appreciably with a change in temperature. More recently, following correspondence with Mr. Walter Pinner, this effect of temperature was determined with specimens from which the edges had been cut off, and of which the average thickness was hence more accurately known. The results are summarized in

TABLE 2

Effect of Temperature on Rate of Solution of Chromium in Concentrated HCl

Temperature °C	°F	*Rate* sec/0.00001 inch	Percentage Deviation from rate at 25° C
15	59	14.6	+18
25	77	12.3	....
35	95	8.3	−32

From these data it is evident that for a precision of about 10 per cent, the temperature must be kept constant within about 5° C (9° F) at lower temperatures, or within about 3° C (5° F) at higher temperatures, or else a correction must be made for the temperature. No doubt this relatively large temperature coefficient accounts for some of the discrepancies reported with this method.

III. POROSITY

For all plated metals except those on which the coating is anodic toward the base metal (for example, those with zinc and cadmium on steel), the protective value of the coating depends largely upon its freedom from porosity. If, therefore, appropriate porosity tests could be devised that are at least semi-quantitative, they would furnish a simple means for measuring the quality of the coatings.

Most porosity tests depend upon treatment of the cleaned plated surface with a reagent that will attack any base metal (or intermediate coating) that is exposed through pores or cracks in the coating, and will show some evidence of such attack. The best known of such methods is the "ferroxyl" test, in which a medium containing a corroding agent, usually sodium chloride, and an indicator, in this case potassium ferricyanide, is applied to steel that is plated with a more noble metal such as copper, nickel, or chromium. Under such conditions, blue spots appear wherever the steel is exposed.

Such methods furnish a rough indication of the presence, size and number of pores in a given coating. When they are applied by the same operator to similar coatings, the results may serve

to differentiate good, fair, and poor coatings. Attempts made here and elsewhere to standardize such tests so that they may serve as quantitative specifications have not been very successful. The size and number of the spots depend upon the exact conditions used in the test, especially the quantity and viscosity of the liquid reagent.

It is very difficult to make quantitative tests for porosity, because it is practically impossible to prepare specimens of known porosity to serve as standards. In many (but not all) deposits it may be assumed that the porosity decreases as the thickness is increased. This generalization has been approximately confirmed in exposure tests. If, therefore, a given porosity test places a series of specimens in the reverse order of thickness, it may be assumed to be approximately correct.

Efforts were made to produce degrees of porosity that were known relatively, if not actually, by cutting lines through the coatings of nickel on brass with a sharp instrument. It might then be assumed that if similarly produced lines on one specimen were 20 cm long, and those on another were only 5 cm long, four times as much base metal would be exposed on the first as on the second specimen. At best, this method was not very satisfactory, not only because the lines varied in width, but also because in all cases the amount of base metal exposed was much greater than on normal specimens with even very thin coatings. It was therefore necessary to judge the value of the following methods principally by the relation of the results to the thickness and probably porosity of the coatings. The following conclusions refer to coatings consisting of nickel or chromium or of chromium over nickel.

A. On Copper and Brass:

(1) *Ferroxyl Test.*

At various times it has been reported that when the ferroxyl reagent is applied in a saturated paper to coatings over copper, red spots appear, as the result of the formation of cupric ferrocyanide. In applying this test to nickel-plated brass, it was observed that, as previously reported in tests on plated steel[5], too high a concentration of ferricyanide attacks the nickel, and may yield red spots where the nickel was thin but not actually

[5]Strausser, P. W. C., Brenner, A., and Blum, W., J. Research NBS 13, 519 (1934); (RP 724).

porous. With a low concentration, for example 0.5 g/l of potassium ferricyanide, the appearance of red spots was not reproducible, and showed little relation to the probable porosity. On brass plated directly with 0.0001 inch of chromium, known by previous tests to be very porous, very few red spots were produced. Addition of ferrocyanide to the reagent made no improvement.

(2) *Trichloroacetic Acid Test.*

In recent years a solution of trichloroacetic acid (CCl_3COOH), made alkaline with ammonia (and therefore really ammonium trichloroacetate), has been employed to detect porosity of nickel coatings on copper or brass. In the present tests the following solution was used.

Trichloroacetic acid	100 g.
Water	400 ml
Ammonium hydroxide (sp. gr. 0.90)	400 ml

This is similar to, but slightly more concentrated than, the solution specified by the American Society for Metals[6] for testing nickel or tin coatings on bolts and nuts made of brass and other copper alloys. When a plated specimen is immersed in this solution, the latter acquires a blue color if the coating is porous. The time required for the appearance of a blue color is used in the above specification as an indication of the porosity. However, the lowest intensity of blue color that can be detected will vary with the individual and with the conditions of illumination, hence the test as described is only qualitative.

In an effort to make it quantitative, plated specimens of known area were immersed in a definite volume of the solution for some specified time, for example thirty minutes. The amount of copper then present in the solution was estimated colorimetrically, by direct visual comparison of the blue color with those of a series of solutions containing known amounts of copper. It was found that for very thin, and presumably porous coatings, the amounts of copper dissolved were in the reverse order of thickness. However, nickel coatings with a thickness of 0.0002 inch or more yielded practically no blue color, though they probably had some pores. The method is therefore useful chiefly for detecting extreme porosity.

[6]Metals Handbook, 1936 Edition, p. 519.

(3) *Ammonium Persulphate.*

Recently an ammoniacal solution of ammonium persulphate has been used by the Bell Telephone Laboratories[7] for similarly measuring the porosity of coatings on brass. They employed an aqueous solution containing 10 g/l of ammonium persulphate, $(NH_4)_2S_2O_8$, and 75 m/l of ammonium hydroxide, sp. g. 0.90. The specimens were immersed for 30 minutes, after which the dissolved copper was determined colorimetrically.

As this solution acted very slowly on nickel-plated brass, the concentration of ammonium persulphate was increased to 50 g/l. The results were more promising, and placed thin porous coatings in their probably correct order of porosity, but the method is at best only semi-quantitative.

(4) *Salt Spray.*

Exposure of plated brass to a 20 per cent salt spray at 35° C (95° F) produced practically no failure at the end of 24 hours. Within 96 hours a few nearly white stains appeared on most of the specimens, but there was no consistent relation between the resultant ratings and the thickness and probable porosity of the coatings. The only specimens which showed distinct failure were those (B 47) with only 0.00005 inch of nickel. This test is therefore of little value for testing plated brass.

B. On Zinc:

(1) *Copper Sulphate.*

It was reported by Bauer, Arnt and Krause[8] that porosity of nickel or chromium coatings on zinc can be detected by simple immersion for about 10 minutes in an acidified copper sulphate containing,

Copper sulphate, $CuSO_4.5H_2O$	100 g/l
Sulphuric acid, conc.	10 ml/l

Copper is deposited in any pores in the coating.

Experiments with this method showed that it readily detects pores in very thin coatings, such as those tested by the above authors. With less porous coatings it is difficult to detect any copper, much less to estimate its area. This test is therefore merely qualitative.

(2) *Electrolytic.*

In an effort to develop a quantitative test for porosity, a primary cell was set up in which one electrode was the plated

[7] Private communication.
[8] "Chromium Plating"—Translated from the German by E. W. Parker, Edward Arnold and Co., London, 1935.

zinc and the other was a strip of copper. The electrolyte contained,

Copper sulphate, $CuSO_4.5H_2O$	10 g/l
Sulphuric acid, conc.	15 ml/l

In such a cell, any zinc that is exposed through pores in the coating tends to pass into solution, while an equivalent amount of copper is deposited upon the copper strip which serves as the cathode. By placing a milliammeter in the external circuit between the two electrodes, the current that passes can be measured. This becomes nearly constant after about 3 minutes. The anode current density, that is, the current per unit area of the plated zinc, is a measure or expression of the porosity of the nickel coating.

Tests with this method showed that the current density decreased from about 30 to 2 milliamperes/dm^2 as the thickness of nickel was increased from 0.0002 to 0.001 inch, and that the specimens were placed in about the same order as was subsequently found in the salt spray. With a given thickness of deposit, the current increased linearly as the area of the specimen was increased. The method is therefore promising. These tests were made on flat plates, and further work will be required to determine whether the method is equally satisfactory for articles of irregular shape.

(3) *Sodium Hydroxide-Sugar Solution.*

Bauer and his associates proposed to detect pores in coatings on zinc by immersion in a reagent that will evolve hydrogen wherever zinc is exposed. For this purpose they used a solution containing 300 g/l of sodium hydroxide and a sufficient concentration of cane sugar to make the solution very viscous even when heated. A small amount of glycerin was added to prevent crystallization of the sugar. When this solution is heated to 80° C (176° F) and the plated article is immersed in it, bubbles of hydrogen appear at pores. When the solution and specimen are allowed to cool, the solution nearly solidifies and thus fixes the bubbles in position, so that they may be counted or photographed.

A few experiments with this method showed that it detects pores only if they are relatively large and numerous, but is not satisfactory for moderately thick coatings with low porosity.

(4) *Salt Immersion Tests.*

Simple immersion of plated zinc in solutions of sodium chloride

or ammonium chloride for periods up to 96 hours produced white or dull spots at pores in the coating, but the results were not very reproducible or significant.

(5) *Salt Spray.*

The customary salt spray test was found to yield results that place the specimens in their probably correct order, that is, in the inverse order of thickness. The test was conducted with a 20-per cent solution of pure sodium chloride, at a temperature of 35° C (95° F). The tests were conducted for 96 hours, with inspections at 24-hour intervals. Failure of the coatings resulted in the formation of white spots or stains. The results were expressed by means of the same numerical ratings that are used in the exposure tests, in which a rating of 5 represents no failure, and a rating of 0 corresponds to failure of at least 50 per cent of the surface. Just as in previous studies of the salt spray test, it was found that the rating at the end of a specified period, such as 24 or 96 hours, is a more reliable criterion of quality than is the period required to produce initial failure.

That the salt spray test yielded approximately quantitative results is indicated in Table 3. (See page 834)

The data from this test show clearly that the porosity is decreased, hence the protective value of the coating is increased, by increasing the thickness of nickel, or of copper plus nickel. In general, the coatings that contained a copper layer were superior to those with nickel only. However, this is no proof that a similar relation will be observed in various atmospheric exposures.

IV. CONCLUSIONS

1. Numerous satisfactory stripping methods are available for measuring the average thickness of nickel and chromium coatings on non-ferrous metals.

2. The microscopic method is generally applicable for measuring the local thickness (except perhaps of very thin coatings such as those of chromium).

3. The jet test for nickel is suitable for testing coatings deposited under similar conditions, but may require separate standardizations for coatings deposited from widely different baths.

4. The spot test for chromium is satisfactory if the temperature is controlled or if a correction for temperature is made.

5. None of the porosity tests of plated brass is promising as a basis for a quantitative specification.

6. The salt spray test appears to be the most satisfactory method for testing the porosity and protective value of nickel and chromium coatings on zinc.

The author desires to express his appreciation for advice and assistance received from the Research Committee of the American Electro-Platers' Society, and from the staff of the National Bureau of Standards, especially from W. Blum and from A. Brenner, who conducted the initial experiments on many of the stripping tests here described.

TABLE 3

SALT SPRAY TESTS ON PLATED ZINC-BASE DIE-CASTINGS
(All specimens except Z 31 and Z 33 had 0.00002 inch of Cr over the final nickel.)

Spec. No.	*Type of Coating**	*Total Thickness inch*		*Rating after* 24 *hours*	96 *hours*
Z 31	Direct Cr	0.0001		0	0
Z 33	Direct Cr	.0001		0	0
			Av.	0	0
Z 48	Ni (H.S.)	.0002		1	0
Z 20	Ni (H.S.)	.0003		1	0
Z 19	Ni (H.S.)	.0005		2.5	0
Z 35	Ni (H.S.), Ni(S)	.0005		3.5	0
Z 40	Cu, Ni	.0005		3.5	2.5
			Av.	3.2	0.8
Z 47	Ni (H.S.)	.001		4	2
Z 37	Ni (H.S.), Ni(S)	.001		4	1.5
Z 41	Cu, Ni	.001		4.5	4
			Av.	4.2	2.5
Z 38	Ni (H.S.), Ni(S)	.002		4	4
Z 42	Cu, Ni	.002		4	4
			Av.	4	4

*H.S. = High-sulphate nickel bath.
S. = Standard nickel bath.

CHAIRMAN HOGABOOM: I am quite sure a number of you will want to comment or ask questions. This paper is very important because it gives you a more rapid knowledge of testing. The outdoor exposure tests will be the yard-stick by which the accelerated tests can be measured, and therefore they should be studied. I think the Society is greatly indebted to Mr. Strausser for the pains taken in his work and for his report. The paper is now open for discussion.

MR. C. F. NIXON (Detroit, Michigan): I should like to ask Mr. Strausser whether we can simulate the blister condition in the salt spray test as is obtained with those coatings in the outdoor exposure test?

MR. STRAUSSER: I wonder if I may pass the question over to Mr. Reinhard. I believe the exposure would give the results. Would it not, Mr. Reinhard?

MR. C. E. REINHARD (Palmerton, Pennsylvania): Yes, I think if you allow those specimens to lie around after they have been tested in a salt spray that they are somewhat similar to those produced in outdoor exposure.

MR. STRAUSSER: You see, the temperature was 95° F., and of course the steam bath is quite a bit higher temperature.

DELEGATE WALTER MEYER (Bridgeport Branch): In regard to the stripping of nickel deposits from copper and brass base metals, we have found that if the concentration of hydrochloric acid is greater than five per cent, marked attack upon the base metals is observed in anodic stripping processes. It is probably associated with the fact that during the stripping an insoluble film of cuprous oxide is formed, which is insoluble in dilute HCl but is soluble when the concentrations of HCl are greater than five per cent. May I recommend that more study be made of this problem, as it has a practical significance.

"Mr. STRAUSSER (*Communicated*): Since the convention, tests, were made in which nickel was stripped from rolled high brass by reverse current in solutions containing 2, 5, or 10 percent of hydrochloric acid (by volume), using from 1 to 2 volts. In all cases the brass was attacked sufficiently to cause an error of from 30 to 60 percent of the weight of nickel coatings 0.0002 inch thick. When such stripping is used, analytical determination of the nickel is therefore recommended"

CHAIRMAN HOGABOOM: Is there any further discussion?

MR. GEIGER: I have found with plated brass work that the solution of ten per cent of sodium chloride salt spray will bring out porosity in a piece which will stand up three hours, and many of the hardware parts that are going around today do not stand up even three hours, and in these tests I find that they jibe up very accurately.

MR. STRAUSSER: That is, you used ammonium chloride instead of sodium chloride?

MR. GEIGER: Yes, ten per cent ammonium chloride instead of ten per cent in the spray, and that brings out the porosity in a very few hours.

MR. STRAUSSER: Is that on nickel or brass?

MR. GEIGER: Nickel and brass.

CHAIRMAN HOGABOOM: That is very interesting. Have we any other questions?

MR. C. W. SMITH: Mr. Strausser, I wonder if you have also experimented with the die-casting.

MR. STRAUSSER: No, we have not.

CONTRIBUTION FROM NEW YORK BRANCH

We wish to acknowledge with thanks a contribution of $300 received from Mr. F. J. MacStoker, Secretary of New York Branch and Chairman of the 1937 Convention Committee.

This money goes into the General Fund and will be used for the welfare of the Society.

Watch This Space
For Details
of the
A. E. S. Convention

Milwaukee, Wisconsin

June 13, 14, 15 and 16

1938

The Manufacture *of* Rhodium Plating Solutions

By LIONEL CINAMON
President, Special Chemicals Corporation

Read at the New York Convention 1937

RHODIUM was discovered in 1804 by Wollaston. It is so named from the Greek, a rose, in recognition of the color of the dilute aqueous solution of its salts.

Rhodium in the fused condition is a brilliant white metal with a blue cast, rather brittle and difficult to roll or draw. Its most frequent commercial form is a dense, heavy, grey powder.

Typical analysis of the various platinum ores show approximately 0.5% rhodium. A comparison of physical properties of both show:

0.5% Rh	*Rh*	*Pt*
At. Wt.	102.91	195.23
m. p.	1955° C	1755° C
b. p.	2500° C	4300° C
Sp. Gr.	12.5	21.45

In the period between January, 1929, to date, platinum has dropped from $70.00 to almost $20.00 an ounce, and now sells at about $52.00 an ounce. Rhodium, during the same time, shows a price range of $40.00 to $135.00 an ounce.

Rhodium occurs as an alloy in platinum ore and osmiridium. The principal sources of supply are: The river sands of the Ural Mountains, Columbia, South Africa, and in the mattes of copper and nickel refining in Canada. As far as the Canadian supply is concerned, the precious metals taken out in any quantity are platinum and rhodium.

Rhodium is used alloyed with platinum for crucibles, thermocouples, oxidation of ammonia gauze, contact points, and scientific apparatus. Rhodium black has been used for producing a black color in the decoration of porcelain. The electrodeposition of rhodium has been known for many years, and is now becoming increasingly popular as an ornamental and protective coating.

Rhodium does not oxidize nor is it attacked by sulphides at room temperature. Pure rhodium, unless very finely divided, is very inert and difficult to bring into solution.

Refiners of precious metals generally have the metal in solution, and sometimes work it to the proper plating salts without metalizing. A means of getting rhodium metal into solution is to heat finely divided rhodium intimately with sodium chloride to redness in a Silica tube and passing moist chlorine through during the heating. By this means the rhodium is converted into sodium rhodium chloride. Another method is to fuse potassium sulphate with the rhodium, but we were never able to get more than a 40% conversion with this method; and because the nuisance and bother was so great, this latter process was discontinued from the start. Rhodium, sulphuric acid and sodium sulphate can be refluxed for a long time, giving between 80 to 90 per cent conversion. The rhodium sulphate may be used for plating purposes. Dissolving C. P. ammonium rhodium chloride in acid have given good plating solutions. Some other methods that are used in getting the rhodium into a finely divided state are fusions with zinc, lead and bismuth, either alone or in varying proportions with each other. The base metals are then dissolved out and the resulting finely divided rhodium is very susceptible to acid action. The rhodium in this condition may be explosive and should be kept moist.

As far as we know the only successful commercial baths use sulphuric acid or phosphoric acid electrolytes.

In 1931 we investigated tartaric, benzoic, citric, oxalic and phosphate baths. We believe the phosphate bath is far superior to any of the so-called organic acids. We obtained passable plating baths with the tartaric acid.

The following procedure has been used by the author for the past six years in the manufacturing of rhodium plating solution from the rhodium metal:

We will start with two ounces of rhodium metal, and all subsequent quantities will be based upon the conversion of two ounces at a time. Ten to one ratios of lead to rhodium is used to get rhodium into solution. We therefore use twenty ounces of C. P. test lead to two ounces of rhodium. These are mixed on a sheet of paper together with a little sodium bicarbonate and borax. When intimately mixed the entire batch is put into a sand crucible and heated in a gas air furnace until the reaction ceases and there is a mirror-like appearance on the top of the melt. The heat is applied slowly for five minutes in

order not to crack the crucible, and then with a full flame for fifteen minutes.

While this is going on, prepare an iron mould large enough to hold the melt, by rubbing a little oil on the inside and then pre-heat the mould slightly.

Pour the melt into the mould rapidly so that the flux will flow to the top and too rapid a chilling of the melt is prevented. Allow the melt to cool until solid, and then the mould and melt can be plunged into cold water. The button is then taken out of the mould. Wash the button with cold water and chip off the excess flux which also can be dissolved. Heat the button in a hydrochloric acid (50 cc hydrochloric to 500 cc water) until the flux either dissolves or softens sufficiently to be removed with a knife blade. This generally takes about two and one-half hours. Rinse the button clean in water.

Place the button in a six liter porcelain evaporating dish and add four liters of water and one liter of C. P. nitric acid. Heat over a small flame until button completely dissolves. While dissolving, the lumps that form can be shifted about and broken with a stirring rod. After the lumps have disappeared, turn off the flame and allow to settle for a half hour. Decant the clear top liquid, which should contain all of the lead into a 5-gallon crock. It might be advisable to send this liquid through a suction filter before putting into a crock, using the same filter paper to filter and wash the finely divided rhodium. The precipitate is filtered and washed until a test with chromate indicates no more lead. In order to prevent a colloidal condition, a very dilute hot solution of nitric acid (1 cc to 1 liter) is used. If the last filtration is colloidal it should be added to the next lot of rhodium instead of pure water. However, the dilute nitric acid wash waters are generally sufficient to avoid this condition. Transfer the precipitate and paper into a two-liter Erlenmeyer flask and add 100 cc of water. Stir until even division. Add 300 cc concentrated sulphuric acid while stirring. Place a 360° C thermometer in the Erlenmeyer flask. Heat slowly because of foaming which would start at 180° C. Another reaction will start about 240° C and continue to about 265° C. Heat should be maintained until the temperature reaches 300° C. Let stand until completely cooled.

Prepare two 2-liter flasks each containing one liter of cold,

clean water. When the rhodium sulphate is completely cooled, pour the latter slowly and cautiously into the two Erlenmeyer flasks, rotating the liquid in the receivers before each addition. Wash the balance of the solution and whatever precipitate remains into these two-liter flasks. Allow to stand, and a blackish white precipitate will settle out. This is a combination of lead sulphate and undissolved rhodium. Allow this precipitate to settle over night because in adding the rhodium sulphate to the water, lead sulphate is precipitated by dilution and sufficient heat is generated to keep some of the lead sulphate in solution. The following morning the lead sulphate is generally in a compact, non-colloidal state at the bottom of the flasks.

Filter the solution and wash precipitate free of rhodium, which is indicated by lack of a red color. Place precipitate in a one-liter beaker for treatment as follows: Add three times its dry volume of soda ash. Make volume up to 500 cc with water. Boil and stir for ten minutes. Filter and wash with water until neutral. Place precipitate in original beaker and add dilute nitric acid, stirring until no further action. Filter and wash, placing filtrates into slops. The precipitate is dried and ignited and put into the next rhodium button melt.

The rhodium solution and washings from the main batch are then placed into two 5-gallon bottles and filled three-quarters full of water. Add ammonia in small portions, stirring after each addition until the rhodium is completely precipitated, avoiding excess. Fill the bottles up to the top and stir. Allow to settle; drain off the clear supernatent liquid. Wash until free of sulphates. This will take ten to fourteen washings and decantations. The decanted solution should be placed in 25- or 50-gallon crocks slightly acidified. The rhodium solution in the crocks is precipitated with sheet zinc, adding more zinc as the zinc is dissolved.

When the rhodium precipitate is free of sulphates, filter the precipitate in a suction funnel until a large crack develops. Do not dry completely. Place precipitate in an evaporating dish. Up to this point rhodium hydroxide is made the same way, both for the sulphate and phosphate solutions.

In order to convert rhodium hydroxide precipitate into rhodium sulphate, add four cc of sulphuric acid for every gram of original rhodium, which in our case means 250 cc of sulphuric

acid. Heat is then applied slowly because of foaming until complete solution. The rhodium hydroxide goes into solution rather slowly but completely. Add one liter of distilled water, cool, filter and wash until no red color is evident in wash waters. This finished rhodium sulphate solution is then brought up to mark in a volumetric flask and a rhodium test is made. The method of testing rhodium will be given later.

To convert the rhodium hydroxide into a rhodium phosphate solution, add eight grams of phosphoric acid to every gram of original rhodium, which in our case means 500 grams of 85% phosphoric acid. Heat slowly because of foaming until the rhodium is completely dissolved. Add one liter of distilled water, and filter. Cool the filtrate and bring up to mark in a volumetric flask and run a test for rhodium content.

The method used in the running of rhodium analysis at this point is based upon the fact that pure rhodium is all we have in the solution, and the impurities that may be there are in such small portions that they can be neglected completely. It is advisable to run duplicate analysis.

Into a 250 cc beaker, pipette 5 cc of rhodium solution, add about 1 cc of sulphuric acid, dilute to 150 cc with distilled water. Place two or three small pieces of C. P. acid soluble zinc shot into the beaker, covering it with a watch glass. Gently warm the beaker to accelerate the action. When the solution is colorless, boil gently until all zinc is dissolved and for five minutes longer, if necessary adding a little more sulphuric acid. Filter on a previously prepared weighed gootch crucible containing an asbestos mat and wash free of acid. Dry precipitate and crucible, being sure not to heat above 200° C. Place in a dessicator until cooled, and weigh. Subtract the tare weight from the final weight. This will give the amount of rhodium in sample, which when multiplied by the appropriate factor will give the total weight of the rhodium. A good rhodium assay range is from 1/10 of a gram to 0.25 of a gram. Results should check within one per cent.

In testing rhodium phosphate solution for plating, prepare bath containing one gram of rhodium and fifteen grams of phosphoric acid in 500 cc of distilled water at 23° C, using a round platinum anode. Take a copper strip (1″ x 4″ x .005) previously electrically cleaned, and plate six square inches at

eight volts for five seconds. If not covered in five seconds, plate five seconds more until covered. A proper bath will just about cover in ten seconds and completely cover in fifteen seconds. This will give you speed of plate. Take another strip of copper and plate for two minutes at a one-half ampere per square inch; compare the color with standards. Standards should previously have been selected for the maximum yellow range and maximum blue range, and the solution should give a plated color in between.

In testing rhodium sulphate solution for plating, prepare a bath containing one gram of rhodium and 40 grams of sulphuric acid; dilute to 1,000 cc. Heat to 80° C, using a circular platinum anode, at eight volts; plate six square inches of copper strip (1" x 4" x .005) previously electrically cleaned, for fifteen seconds. Plate should appear white in center with a slight frostiness at edge, if any, and should be completely covered. Plate another piece of copper strip for fifteen seconds at two amperes to the square inch and check against previous accepted standards. Upon electrolyzing the latter bath, a slight precipitate may form. When this happens, electrolyzing the entire lot for ten minutes at eight volts at room temperature, then boiling, adding 40 grams charcoal (Norite "A"), filtering when hot, will cure this tendency. If not, repeat operation. Charcoal wash waters are put into slops. Do not add them to good solution. After this treatment a new assay must be made.

From time to time brighteners are added, but should be avoided. A study of the effects of several ions was made. A very slight trace of ammonia whitens the color of some poor baths, while an excess throws it off. Any amount of sodium ion is detrimental to color. While traces of cadmium were sometimes beneficial, too much threw the color off. In dissolving rhodium metal directly with sulphuric acid it was found that the color was usually off because of too high a purity. A slight trace of lead brought out the proper shade. However, excess of lead gives a leady cast. The excess of lead can be worked out of solution by continually plating, the lead coming to the anode as lead peroxide.

The pH of a rhodium phosphate plating bath should be between 1.1 and 1.5 for optimum results. In the sulphuric acid bath

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we found that a pH below one works satisfactorily. Its critical range is greater than the phosphate solution.

In plating practice, rhodium sulphate solutions are worked with a concentration of 1 gram of rhodium metal and 4 to 40 grams of sulphuric acid per liter. The best plating results are obtained about 80° C. Four to six volts are used; the plating amperage should not be over two amperes per square inch. When two amperes per square inch are used, a ten-second plate is considered sufficient for ordinary use. A fifteen-second plate will begin to show a tendency to burn. However, rhodium sulphate has been successfully plated at amperes as low as 1/10 ampere and also at room temperature. The manipulation seems to be dependent entirely upon the type of work and the idiocyncrasies of the plater.

The rhodium phosphate solution is generally used with a plating concentration of two grams of rhodium and 30 grams of phosphoric acid per liter. Room temperature (25° C) is usually employed, plating between seven to ten volts at not over one-half ampere per square inch. A two-minute plate at one-half ampere per square inch will plate one milligram per square inch. At 35° C the bath will plate twice as fast, while at 45° C the bath will plate four times as fast as at 25° C. It is not advisable to go above these temperatures because the color of the rhodium plate is affected. There are unusual cases where phosphate baths are plated at higher temperatures, but that is because of a special problem in a particular plant.

In order to make rhodium phosphate solution more conductive five grams of sulphuric acid per gram of rhodium is sometimes added. The resulting bath will then plate between four to six volts and have practically all of the characteristics of the phosphate bath as to color, and will plate much faster. There is a great difference in color of plate between putting sulphuric acid in rhodium phosphate solution made from rhodium hydroxide, and putting phosphoric acid into rhodium sulphate solution made from rhodium hydroxide. As a rule, we avoid sulphuric acid in the phosphate bath because of the greater health hazard sulphuric acid has over phosphoric acid.

We cannot plate rhodium directly on all metals. We have no difficulty plating on silver, copper, nickel, German silver, platinum, paladium, gold, higher karats of gold, 10 karat and

up not containing a high proportion of zinc. We cannot plate directly on lead, tin, antimony, cadmium, chromium, iron, stainless steel or alloys of these metals, such as white metal, dye casting metal, brass, etc. To overcome this obstacle we plate with a metal that will "take", and plate rhodium on this underplate.

The best underplate available is a soft nickel because of its hardness, ease of manipulation, white color and cheapness. Silver, copper, gold and paladium are sometimes used for underplates, depending upon plating conditions.

Rhodium plate is slightly porous. Silver is attacked through these pores, and the oxides and sulphide of silver force their way through the pores and give an oxidized finish to the surface. This process may take months, and is objectionable. The oxidized finish can be removed by wiping, and the rhodium plate will be there as nice as when first put on. To overcome this difficulty on silver bases, a flash of soft nickel is put on first, which effectively retards this action.

Cleaning is a very important factor when rhodium plating. Rhodium plating solutions will not clean as they plate, and if any dirt or grease is left on, a discolored spot will show. The work must show no "water break" before being put into the rhodium plating tanks.

There are some methods used for stripping that might be of interest. Rhodium, because of its inertness, cannot be stripped by attacking the metal itself. It can be stripped if the metal is of an insufficient thickness, the undermetal being attacked through the pores of the rhodium plate. The rhodium will then come off in flakes. If we have a rhodium plated article that can stand heat up to 500° C, then the oxidized rhodium can easily be removed because of oxidation, in the usual way; in fact, buffing alone will sometimes suffice. Of course, if the article is full of low-melting solder, it will come apart. There are other methods of stripping rhodium, but good judgment should be exercised.

On articles of a silver base, a muriatic acid strip with reversed current acts more or less efficiently; however, the article will have to be refinished. Articles composed of gold, higher karats of gold, should be stripped in either a nitric or sulphuric acid solution. For articles having a nickel base, the author would

suggest muriatic acid. Phosphoric acid can be used to advantage on nearly all metals. Sodium cyanide with reverse current can appropriately be used. The choice of acid or stripping method should be one that has the least effect upon the underlying metal. Under these circumstances the gassing and slight attack of the base metal through the pores will be sufficient to flake off the rhodium coating.

We have been often asked about methods of oxidizing rhodium. Although we make a blanket statement that rhodium cannot be oxidized directly, there is one unusual method of accomplishing this. If sulphuric acid containing sulphur is put on the rhodium plate and heated, a black rhodium sulphide will form. The commercial methods of oxidizing rhodium are to put on a plate, such as a black nickel or arsenic black, and then relieving, or else flashing in copper, dipping in an oxidizing solution and relieving.

It might not be amiss, at this point, to set forth the time proven soft nickel underplate:

12 oz. single nickel salts per gallon
2 " epsom salts " "
½ " nickel chloride " "
4 " double nickel salts " "
2 " boric acid " "
pH — 5.7
Voltage — 2

CHAIRMAN SERVIS: Are there any questions on this paper?

MR. HALL: I think Mr. Cinamon is to be commended on his originality in telling us how rhodium should be dissolved. It is something which has always been somewhat of a mystery to those who have not been on the inside in the manufacture of the rhodium solution.

I notice Mr. Cinamon made a statement that rhodium cannot be stripped until you strip the base metal. A fellow by the name of Atkinson took a patent out in New Britain a few years ago, and his patent takes advantage of the fact that all the metals of the platinum group are soluble in a few alkaline cyanides, and suggests the use of a mixture which loosens the plate. I never had the chance to try it, but I wonder if you have had any experience with it.

MR. CINAMON: In running our tests, about six or seven years ago, on methods of stripping and methods of getting the solution, we tried practically everything. At that time we tried

different sodium cyanide strips, and we were successful in flaking off the rhodium, but we never tried a fuse bath because, obviously, that is not a very practical method.

MR. HALL: I think that fusing might be very practical in the case of rhodium, because of the fact that the largest amount of rhodium today is used by jewelry concerns. Most of the jewelry plants are equipped for melting metals and the articles are small in size. Another point I want to mention is that the fellow who has that patent suggests the use of reverse current mainly for small sizes. This would lend itself for practical operation in the case of jewelry, because of the small size of the articles.

MR. CINAMON: I have no answer to that.

DELEGATE WITTIG: Two years ago, when we went to Bridgeport, I asked everybody the question, "How can rhodium be stripped?" I started with Oscar Servis; I thought maybe he could tell me. He said, "Strip it the same as you do nickel, in sulphuric acid and reverse current." Then he said, "If you want to find out anything about that, see Fletcher." I went to Fletcher and asked him, "What do you know about stripping rhodium?" "Nothing," was the answer. Then I went to Horace Smith; he is right down in their district. I said, "Horace, how do you strip rhodium?" He said, "I don't know anything about it. We don't do rhodium plating, so I don't have to strip it." Then I asked Schulte, "How do you strip rhodium?" He said, "That's just what I came to Bridgeport to find out, but I haven't found out."

I asked eight or ten other men how to strip rhodium, and they knew nothing about it. This year I asked some of the same fellows, "How can I strip rhodium? It's two years since I asked the question." The most I can learn is that you loosen it and flake it out, but the metal will not come off because I tried the sulphuric acid, just the same as you strip nickel, and it did not strip clean. I would scratch and scratch, and I have not been able to find out anything about regular stripping off. You tell us it must flake, it really is loosened by the current in the chemical attacking it, and then you can flake it. You would never get a nice clean job on a piece of jewelry that way. In our city I was going to do rhodium plating, but as I did not know how to strip it, I did nothing about it.

One who told me he liked rhodium was Mr. Gilbertson, of Chicago.

I am in a small jobbing shop, and I get rings to nickel plate, and I know I get almost as much for nickel plating a ring as they get for rhodium plating a ring. I get twenty-five cents a ring, and will size the ring. They will size the ring and rhodium plate it for thirty-five cents. I did not get the information, though, on how to strip off rhodium. I may strip it by flaking and brushing.

MR. CINAMON: The method commonly used or sometimes used in the jewelry trade to overcome that difficulty (we are assuming that it is better grade of merchandise) is to put a torch on it, an ordinary gas-air torch that you use for soldering, and you will find that under those conditions the rhodium will turn a grayish black. The rhodium will oxidize at about 450° C. If you heat it up to 500° C you get a nice oxidized coat on there that will come right off. That is one of the reasons why some of you may have noticed, in the method of analysis, that there has been recommended heating rhodium red hot and then cooling it. Well, in doing that you are going to get improper results.

MR. ELSTER: Mr. Cinamon, I would like to know whether you have had any experience with brown spots appearing on rhodium plating.

MR. CINAMON: Those brown spots are generally due to a faulty cleaning, assuming that the metal is one that will take a good rinse.

MR. ELSTER: These are just brown spots, like dots.

MR. CINAMON: Well, the only brown spots that I am acquainted with are those that occur if the rhodium solution is not clean. The articles are sometimes put into soap water and ammonia water as a final drying-off process, and if all the soap is not taken off, yellow or brown spots will form. If you can show me a piece of work, or send it to my place, I will be glad to examine it and pass comment on it.

MR. ARCHER: I would like to ask the speaker which solution, phosphate or sulphate, gives the whitest deposit; and a bath that is contaminated with nickel, if it is possible to recondition the bath.

MR. CINAMON: I shall take the second question first, because it is the easier to answer. A bath contaminated with nickel

cannot be recovered. The nickel itself can be put in a rhodium bath before the color goes off, but a bath containing too much nickel will give you a dead cast, and the cheapest thing is to refine it.

Now, so far as the whiteness of the plate is concerned, the sulphate has a tendency to give a little blue cast over toward the chrome. In jewelry work the object is to get as near to the diamond color as possible, and the rhodium phosphate was primarily designed for that purpose, to give you the same cast as the diamond. In silver work, where it is not so important, they go so far as to use lead anodes in the solution because the slight cast is not as important there as it is in the jewelry work, but as far as color is concerned, the phosphate bath has a more pleasing white appearance.

SPRINGFIELD BRANCH

Educational Session and Banquet

SATURDAY, NOVEMBER 20, 1937
at the HIGHLAND HOTEL

Educational Session at 2 P. M. Banquet at 7 P. M.
Entertainment and Dancing

SPEAKERS:

WALTER R. MEYER — General Electric Co., Bridgeport
"Cyanide Copper Plating"

F. F. OPLINGER — R & H Chemical Division, E. I. DuPont de Nemours Co.
"Practical Methods for the Disposal of Alkali and Metal Cyanide Solutions."

GUSTAV KLINKENSTEIN — Maas & Waldstein
"Specialization of Finishes and Its Effect on the Work of the Electroplater."

Tickets $2.00 Everyone Welcome

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

GRAND RAPIDS BRANCH

The October meeting of the Grand Rapids Branch of the American Electro-platers Society was held at the Kalamazoo Plating Company plant on invitation of Mr. Joe Nook who is owner of the establishment and a member of our society. Besides most of our 24 regular members being present we were glad to have with us two members of the Detroit Branch, Carl Huessner and W. W. Wilson.

A short business meeting was first conducted. One new member was voted upon favorably; he was Mr. Bremer of The Bissel Carpet Sweeper Co. A question box was then opened and several inquiries discussed. One member particularly asked for information regarding the anodic aluminum process and his question was answered very satisfactorily by Carl Huessner who is familiar with the process. He described the type of equipment needed and the nature of the process as licensed by the Aluminum Co. of America. An open discussion on "Plastics" was entered into by all of the members with short talks by Mr. Huessner, Mr. Nook, and Mr. Werft. It is evident that the plater must be up on his toes and watch the quality of his workmanship in order to prevent the substitution of such products as Stainless steel, lacquer, synthetics, various celuloid products, and last but not least—plastics. Plastics are being used to replace the entire metal article in some cases, plastics are being molded over metal, they are being used to coat articles by the dip and other methods.

A fine lunch was served, after the meeting, by Mr. Nook. Then most of the members made a tour of inspection of the plant. Most of the Kalamazoo Plating Company work is on die castings, contracts being held with Pontiac, Oldsmobile, and Hudson. A new addition had just been put on the plant and a complete set-up for racking, cleaning, dipping, copper, nickel, and chromium plating automobile grills was being installed with a new 4000 gal. Udylite semi-automatic unit used for the nickel. The plant is modern in every respect as regards methods and equipment.

The evening (going into the small hours) was wound up with card playing, some of the members playing a wicked pinochle game. The members always look forward to an entertaining and instructive evening when Mr. Nook extends his annual invitation.

CHAS. S. WHALLEY, *Sec.-Treas.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held Oct. 9, at the Atlantic Hotel.

President E. Stepka presided and all other officers were present.

Mr. E. J. Burke was elected to active membership, Mr. G. J. Yochim and Mr. C. L. Shaffer were elected to Associate membership.

The applications of Mr. J. E. Morgan and Mr. W. A. Burke were read and committees appointed on same.

Chicago Branch officers and members were very sorry to hear about Mr. H. A. Haisman, one of our members

who passed away in May. The entire Branch extends to Mrs. Haisman its deepest sympathy.

Mr. Gilbertson chairman of the Banquet Committee reported that progress was being made to make this one of the finest banquets and educational sessions ever held by Chicago Branch. It will be held in the Grand Ballroom of the Palmer House, Jan. 15, 1938. This is the third Saturday in Jan.

Mr. C. Kocour read a paper published on page 164 of the Convention Report on the Removal of Carbonate from Cyanide Solutions. This was very interesting and brought out some very fine discussions. Mr. Kocour also showed three different instruments for measuring the pH of solutions.

Mr. Servis also read a paper on the new Grasselli Carbonate Remover, giving the amounts used, cost, etc.

The following questions were found in the question box:

1. *What is a good acid solution to be used for the removing of hardening scale with current; what is the proper current direct or reverse; also what type anode?*

Ans. A 25% Sulphuric Acid solution. Use warm about 110, lead anode with reverse current.

2. *What makes stainless steel develop rust spots after the parts are finished and how can the trouble be overcome?*

Ans. Presence of iron in polishing or buffing compounds, overheating in polishing or buffing. Two members stated that the way they overcame the trouble was after buffing the parts were run through a cleaner, and dipped in a 10% Nitric dip dry and give the part a light color buff.

3. *What causes a cadmium solution to have a strong ammonium odor?*

Ans. Usually lack of cyanide.

4. *What cleaner is used for cleaning slush mold castings before plating?*

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Ans. 2 oz. Tri Sodium, 2 oz. soda ash, 1/16 oz. caustic soda per gal. Use direct current.

5. *What causes cadmium to turn dark gray in barrel plating?*

Ans. Several reasons. Such as lack of cyanide, not enough current, lack of brightener, impurities such as copper, etc.

6. *What causes milky blotches in chrome plating?*

Ans. Parts get too hot in buffing, lack of current, too cold a solution, and improper racking.

7. *What will strip rhodium plate without attacking the base metal?*

Ans. A 55% of sulphuric acid with reverse current.

8. *What is the pH to operate acid zinc solution and what metal content?*

Ans. 2 or 3 lbs zinc sulphate, and pH of 3 to 4.

9. *What coatings are the hardest, plated zinc or tin coatings, or hot dip zinc or tin?*

Ans. Plated coatings are much harder than the hot dip coatings.

J. W. HANLON, *Sec.*

DETROIT BRANCH

Meeting of American Electro Platers' Society, Detroit Branch was held in Hotel Statler, Friday, October 1st, with a very good attendance. Mr. A. B. Wilson, presided.

There was one application for membership: Mr. William E. Jenks, Eaton Manufacturing Company, 2300 Leroy Street, Jackson, Michigan, active. The following were elected to membership: Mr. Joseph Angaran, 4409 Vermont, Detroit, Mich., Active; Mr. Donald A. Gifford, c/o A. T. Wagner Co., 2700 Wight St., Detroit, Mich., Associate; Mr. Donald A. Gaines, 1936 W. Lafayette Blvd., Detroit, Mich., Associate; Mr. Ralph Roetter, Dresden Hotel, Flint, Mich., Active; Mr. John F. Siefen, 1936 W. Lafayette Blvd., Detroit, Mich., Associate; Mr. W. L. Higgs, King Seeley Corp., Ann Arbor, Mich., Active.

There being no correspondence and the bills having all been taken care of by the Board of Managers, we proceeded directly to the paper of the evening which was read by Mr. Walter L. Pinner of the United Spring and Bumper Corporation. His subject was "The Measurement of Thicknesses of Deposit" and he handled his subject as one who knows. He had quite a few slides which were thrown on the screen for illustration. It was very interesting and educational. There were many questions asked after his paper was read and quite a lot of discussion. Those who were not present missed something very valuable.

After Mr. Pinner's paper was read, it was regularly moved and seconded that we have an educational session during the winter. The committee having been appointed at our last meeting for the banquet with Mr. George L. Nankervis as Chairman. Our educational chairman, Mr. Charles Eldridge will get busy on the educational program for that afternoon.

This matter having been settled, Mr. B. F. Lewis, our acting librarian, collected the question cards. There were quite a few questions asked and there was quite a discussion, the principal subjects being on electro-plating zinc base die cast metals. The questions will be published with their answers in our next issue of the REVIEW.

After the questions were disposed of we had a member who has not been present at our meetings for sometime, one of our past presidents, Colonel Hansjosten. He made a few remarks, among them being that he was very thankful to be able to be present and that he wanted to congratulate Detroit Branch upon the wonderful piece of work they did at the New York Convention in electing for president of the Supreme Society, Mr. A. B. Wilson.

Then there was quite a discussion on the subject of a paper for the Detroit Branch to present at the Milwaukee Convention and it is pretty well assured by the interest shown that this Committee who has this in charge will have a paper very well gotten up and will have a good representative read it at the Milwaukee Convention.

There being no further business, the meeting adjourned at 10:30 p.m.

T. C. EICHSTAEDT, *Sec.-Treas.*

DETROIT BRANCH

Q. Is it any advantage to copper plate or copper strike before nickel plating zinc die castings?

A. Although a copper strike does slightly improve the "throw" of nickel on zinc, this practice is definitely "out" from a durability standpoint. Copper deposits of .00025 inch or more are generally satisfactory both for endurance and for the ease with which any type of nickel may be applied thereon.

Q. What are the relative merits of "wetting agents" versus hydrogen peroxide in nickel solutions?

A. The wetting agents are less troublesome when used in excessive quantities. However, they make the bath more sensitive to grease in very small amounts on the cathode.

Q. Are wetting agents broken down by anodic oxidation?

A. No.

Q. Has anyone had success with the chord method of measuring deposit thickness?

A. Good results are reported on round parts of known curvature.

Q. Are the wetting agents used in bright nickel solutions equally adaptable to ordinary nickel solutions of the Watts type?

A. They have been successfully used. There is, however, some question of patent rights in this connection.

Q. May the pre-treatment of a piece which is to be tested for thickness by the peeled plate method, actually cause less metal to be deposited on it than on other pieces on the same rack?

A. If an oxidizing treatment is used to cause peeling, it seems likely that the first part of the plating period would be consumed in activating the cathode surface, the deposit being somewhat thinner on that account. If the method wherein a non-adherent metal such as acid copper direct on steel is used, no slowing up of the deposition would be expected.

Q. What is the general principle underlying the new color-plating process?

A. In this process, copper is deposited at very low current density in a bath containing organic constituents which cause the deposit to build up through a series of changing colors. The plating is stopped when desired color is obtained.

Q. What is the probable cause of "shading" of the top portion of pieces being bright nickeled?

A. Modern nickel solutions have a high specific gravity. When water is added to the tank to replace evaporation and dragout, the water is so much lighter than the solution that it will "float" or form a layer on top of the solution unless vigorous agitation is used. This light stratum naturally would not produce the same quality of plate as the heavy solution below. Remedy: Add water to the tank only when it is possible to stir the whole solution thoroughly.

Q. What is the cause of blistering on zinc grilles? They are plated full automatic: Cleaner 4 oz. 1½ min., Acid 2% H_2SO_4, 20 sec. Blistering is from the

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base metal and appears only after nickel plating.

A. On a full automatic machine where the transfer is slow, the cleaner should be run at a low enough temperature (say 140°F.) so that the surface does not dry before entering the rinse. Hydrofluoric acid is generally preferable to sulphuric on zinc die castings.

Q. Is it generally concluded that the old method of "Sodium Sulphate" nickel solutions are to be discarded in plating die castings?

A. Since the sodium sulphate solution may only be used at relatively low temperatures when plating nickel directly on zinc, its disadvantages are very great. Excellent results are being obtained, however, using the sulphate bath hot, with the usual copper undercoat. In this case, the sodium sulphate content is about 8-10 ounces per gal., and the metal content 4 ounces per gal.

MILWAUKEE BRANCH

Milwaukee Branch held its regular monthly meeting on the 14th of the month, and we had a grand group of active members present. Our genial President, Ray Goodsell, was in the chair and we got through with our business session in very rapid time. The local group has decided until further notice, to have our educational sessions first, as we are going to have a good many well known speakers for the ensuing year. It seems that by then having our business session last, the members who wish to start home may do so. The Milwaukee Branch has a good percentage of its members from other towns and we hope to induce these members to attend the monthly meetings more regularly in the future.

It is with regret that we have to report the death of Mrs. Louis Zingler, wife of one of the older members here.

The J. B. Ford Co., manufacturers of the well known Wyandotte line of cleaners and detergents furnished us with the speaker of the evening, Mr. Tompkins. He spoke on cleaning methods in general and then the meeting was turned over for a round table discussion. Mr. Tompkins stated that unless there was at least 15 amps per sq. ft. on the work in the cleaning tank the current was actually wasted. Some authorities have stated that from 50 to 60 amps per sq. ft. is just about the optimum. The use of nickel plated steel anodes in the cleaner tank is much better than the usual custom of using the tank. Current loss, with the tank as anode, is excessive and it is also difficult to keep the tank clean enough to carry current to all parts of the work being cleaned.

The ground work is being carefully planned for the 1938 Convention in Milwaukee so plan now on being in Milwaukee on June 13, 14, 15, and 16, in 1938.

Joe Boughner, active, Milwaukee, Wis., made application for admission into this branch.

A. J. HERMANSEN, *Sec.-Treas.*

NEWARK BRANCH

The regular meeting of the Newark Branch, A.E.S., was held on Friday, evening, October 1, 1937, at the Krueger Club, Belmont and Springfield Aves., Newark, N. J. The meeting was called to order at 8:30 p.m. The following officers were present: George Klink, President; William Hodecker, Sr., Vice-President; George Wagner, Secretary; Nelson Sievering, Treasurer; Paul Oldam, Librarian; Roy Stout, Sargeant-at-Arms; and

Trustees Samuel Taylor and Samuel Glickenhaus.

The minutes of the previous meeting were read and approved.

A letter was read from the Duralac Chemical Co. in reference to an application to Associate Membership for Mr. B. Leister, which was turned over to the Board of Trustees for investigation.

Mr. Klink asked for a report on Special and Standing Committees, inasmuch as the Committee was unable to meet there was no report.

Mr. Horace Smith stated that he had received a letter from the Supreme President inquiring whether or not Newark Branch was satisfied with the way the Research Committee was handling its matters. After some discussion a motion was made and carried that Mr. Smith inform the Supreme President that Newark Branch is in full accord with the work being done by the Research Committee. In further comment it was stated that the Manufacturers have supported the Research Committee more than the platers and that the platers had no right to criticize the work being done which has proved so valuable to the plater as well as the manufacturer.

Mr. Oldam thanked the members present for the fine cooperation received in publishing the 1937-1938 booklet and also extended his thanks for the ads received for this booklet.

Mr. George Reuter urged the members to attend his class at school.

The meeting was then turned over to Mr. Oldam who introduced Mr. Nathaniel Hall as the first speaker of the evening. His subject was "Pickling Ferrous Alloys." The following are some of the questions and answers which were put to Mr. Hall:

Q. Why should the repressing of the hydrogen evolution effect the dissolving of the iron?

Ans. We cut down the amount of iron that is dissolved because the solution of the iron itself is an electrochemical reaction.

Q. What is the best method for pickling soft solder on brass? We have a lot of soft soldering on brass done which is first run through a 10% solution of Sulphuric Acid and then through a pickling solution. We feel that when 10% Sulphuric Acid comes in contact with the brass the work will not pickle as readily.

Ans. To correct this fault the thing to do is to use a stronger concentration of Sulphuric Acid that is about 20%.

Q. What is the formula for removing rust spots from Nickel Plated cutlery?

Ans. Use an alkaline solution of Citric Acid, the formula is 10% of Citric Acid per gallon.

Q. After you remove the spots, after a time, will these spots come back?

Ans. Yes, they will.

Q. How would the Citric Acid solution act on gold plated work?

Ans. Citric Acid should not affect gold solutions.

A copy of Mr. Hall's paper "Pickling Ferrous Alloys" will be sent to the MONTHLY REVIEW for publication.

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The next speaker was Dr. K. Shumpelt who gave a very interesting talk on "Alloyed Gold Plating Solutions and Their Operations." Dr. Shumpelt illustrated on a blackboard how the deposits from composition gold solutions, especially gold and silver, change with current density and temperature. He stated that he had made a study of a gold solution containing 70% gold and 30% silver and on analysis of the deposit had found that he could get anywhere from 82% gold and 18% silver to 28% gold and 72% silver just by changing temperature and current density. He also stated that a deposit having the appearance of a 14 or 18 karat gold could be of a variety of compositions ranging anywhere from 10 to 22 karat.

Mr. Hall and Dr. Shumpelt were given a rising vote of thanks from the 42 members present. Meeting adjourned at 11:30 p.m.

GEORGE WAGNER, *Sec.*

NEWARK BRANCH

The regular meeting of the Newark Branch, A.E.S., was held on Friday evening, October 15, 1937, at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

During the absence of our President, Mr. George Klink, the meeting was opened at 9 p.m. by our Vice-President, William Hodecker, Sr. Other officers present were: George Wagner, Secretary; Nelson Sievering, Treasurer; Paul Oldam, Librarian; Roy Stout, Sargeant-at-Arms; and Trustees Samuel Taylor and Thomas Haddow.

Due to the late start and the fact that we had an interesting speaker for the evening the regular routine of business was dispensed with and the meeting was turned over to our Librarian who introduced Mr. William F. Newbery. His subject was "Solvent Degreasing" which proved to be a very interesting talk. Mr. Newbery's talk was illustrated by a moving picture film. Following are the questions and answers created by this talk:

Q. How can you test solvent to determine whether or not it is still in good condition, that is, not contaminated?

Ans. The contamination of your solvent is more or less determined by a Baumé reading.

Q. What is the best procedure to wipe or clean off the remaining drops that adhere to pieces of work prior to plating?

Ans. With correct operation of a degreasing machine, no drops of solvent should remain on work, as same will naturally leave a ring or circular mark. If however you are confronted with this problem, an alcohol wipe is recommended.

Q. Does a degreasing machine work better at the end of the day than at the beginning of the day, all conditions being the same?

Ans. If a degreasing machine is properly operated, and all conditions pertinent to the operation of the machine are the same at the beginning of the day as at the end of the day,

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there is absolutely no reason why the machine should not give identical results regardless of the time of day.

Q. If we find that the solvent itself is contaminated with insoluable oils, is it good practice to let them settle?

Ans. It is not good practice to let insoluble oils settle as this operation would take too long and would not be economical.

Q. Will solvent reach a point where it is unfit for use?

Ans. If Trichlorethylene is used and re-used for a long period of time, it would decompose. Other solvents can be used indefinitely, if distilled at regular intervals.

Q. Will solvent leave oxide film on Gold?

Ans. If degreasing machine is operated correctly, there is no reason why this trouble should occur. If you are having this trouble, it is undoubtedly due to other metal parts you are cleaning in the same machine, other than gold. In order to eliminate this, try distilling solvent at more frequent intervals.

Q. How can you tell whether you have a Grade A or Grade B solvent?

Ans. The only way you can tell is to actually test it.

Q. What is the procedure for cleaning residue from a degreasing machine, particularly caked dirt on coils?

Ans. Best procedure is to drain off soluble materials through the drain valve, remove your steam coils, and wipe down the sides of the machine. Your coils can either be scraped or scratch brushed. Contamination on your coils should never be any more than 1/32".

Mr. Newbery was given a rising vote of thanks by the 34 members present after which the meeting was turned back to our Vice-President who asked if there was anything of importance to be brought before the meeting. Our Secretary brought up the following applications both for Associate Membership: John Gumm, 71 38th St., Irvington, N. J. and Benson Leister, 84 Lister Ave., Newark, N. J.; these applications were voted to take the regular course.

Mr. Taylor, Chairman of the Auditing Committee, reported that the Secretary and Treasurer's books were in very good condition and then read the financial statement for our branch.

Meeting adjourned at 11:30 p.m.

GEORGE WAGNER, *Sec.*

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch of the American Electro-Platers' Society was held at Hotel Cleveland Saturday, October 2, 1937.

Meeting was called to order by our President Mr. Scott at 8:15 o'clock.

Application for membership, Mr. Lester Detre of the Brainerd Steel Corp., Warren, Ohio, and Mr. A. L. Spiser, Republic Steel Corp., Cleveland, Ohio, were received.

The Clambake was held Saturday, October 9th, at the Astorhurst Club, Because of the bad weather there was no ball game or horse-shoes. The gang played cards in the grille room.

After the Bake we danced until about 2:30 in the morning. Every one had a swell time.

CHARLES F. OTT, *Sec.*

PHILADELPHIA BRANCH

Phila. Branch held its regular meeting, October 15, 1937. Meeting called to order by Pres. Joe. E. Underwood. Minutes of previous meeting read and approved. Applications reported fa-

vorably by the Board of Managers: Mr. Raymond C. Eckert, 612 E. Brill St., Phila. Active; Mr. Frank Weover, 1719 Cotton St., Reading, Penna. Active; Mr. Theodore D. Gaul, 1833 Cotton St., Reading, Penna. Active; Mr. James H. Robins, 618 Hazelhurst Ave., Merion, Penna. Associate; Mr. D. Woodward Pritchard, Penna. Salt Mfg. Co., 1000 Widener Bldg., Phila., Penna. Associate; Mr. John S. Dinone, Hatboro, Penna. Associate; Mr. H. P. Jacques, 301 W. State St., Trenton, N. J. Associate.

Moved and seconded that applicants be elected to membership in Phila. Branch.

Communication received from 3rd Vice Pres. Austin Fletcher complied with Pres. Joe. E. Underwood appointed Geo. Long, Chairman, John M. Himes Jr., and Eugene J. Zurback, Jr.

Reading committee reported attendance of 76 members and friends. We wish to thank the members for their co-operation given. The Speaker, Dwight Overcash gave a very interesting and timely lecture on bright nickle deposition; which was well received. Mr. Overcash was given a hearty vote of thanks at the conclusion of his talk. Banquet committee reports a bang up time is in store for everyone attending. This is the time where old friends meet and new ones are made. The educational session programme speaks for itself. The speakers are, Mr. G. Hogaboom, Dr. A. K. Graham, Oliver Sizelove and Mr. Brenner from the Bureau of Standards. The meeting starts promptly at 2.00 P. M. Dinner at 7.00 P. M. Dancing at 9.30 P. M. The dance orchestra is an internationally known orchestra playing both abroad and in this country. We will have something new for the dinner entertainment.

Meeting then turned over to Mr. Al. Hirsch, who introduced Mr. Daviss of the DuPont De Nemours Co. Says boys! you who did not show up at this meeting missed something as Mr. Daviss knows how to put a lecture of this kind over and he knows his color photography. Mr. Daviss was given a rising vote of thanks.

There being no further business the meeting adjourned until Nov. 20, 1937. REMEMBER the date of Banquet, Saturday, November 20, 1937 at "ADAMS," 13th and Spring Garden Sts., Phila., Penna., time 2.00 P. M.

R. E. JACKSON, JR., *Sec.*

LOS ANGELES BRANCH

Minutes of the Los Angeles Branch of the American Electro-Platers' Society's

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regular monthly meeting held Wednesday, October 13, at the Rosslyn Hotel.

President John Marigold presided. Twenty-two members were present.

Minutes and financial reports of previous meeting were read and accepted. Bills for $6.72 were read and ordered paid.

Mr. Maurer outlined the program for the educational hour which begins, Nov. 10.

Mr. Clayton, of the Hanson Van Winkle Munning Co., gave an interesting talk on plating.

The Librarian found the following in the question box:—

Q.—What is the best method of stripping copper and brass from lead so as not to pit the lead?

A.—Use liver of sulphur solution to dissolve the copper deposit and a sulphuric acid reverse current strip for the brass.

Q.—What should I use to clean brass reflectors before silver plating?

A.—Clean in regular hot cleaner or use acetone paste made of powdered lime acetone and water.

Q.—What can I do to improve the throwing power of a low pH nickel solution?

No answer to this question. No one was able to answer this question. We would appreciate information on this subject from any of the branches.

The meeting adjourned at 11 P. M.

RAYMOND SOLIVAN, *Sec.-Treas.*

BINGHAMTON-ELMIRA BRANCH

The regular meeting of Binghamton Branch was held Monday, October 25th in the usual place. Mr. Thomas R. Gill an associate member from Detroit Branch was welcomed to membership in our Branch. We know Mr. Gill is going to be very active and that he will do much towards creating discussion at the meetings.

While we have had to make our meetings at a time best suited to the past speakers, we will now settle down and have our November meeting on the 15th and the December meeting Dec. 13. Thereafter the meetings will be the second Monday. Mr. Frank Mesle of Oneida Ltd. will be the speaker for the November meeting. The subject, "Plating to Specifications and Methods of Measuring Plating Thickness."

Larry Meyer our president, who is to be in charge of the Committee for exhibits from this Branch at the Convention appointed Mr. Harry Herlikoper and Mr. Thomas R. Gill to act on this committee also. It was voted upon to put up two cash prizes the first to be $10.00 and the second $5.00, for the best exhibits by the individual members.

The speaker for the evening was Mr. Thomas R. Gill of the Udylite Co., Detroit, Michigan his subject: "Wetting Agents in the Plating Plant." Mr. Gill presented his subject very well and in a manner understandable to all. The attendance at the meeting was small but the general discussion after in which practically everyone joined, made it outstanding.

A. L. FLETCHER, *Sec.*

BOSTON BRANCH

Boston branch met Thursday, the 21st at the Manger Hotel, Boston, with Pres. Mintie in the chair.

Minutes of the previous meeting read, approved, communications and bills read.

One application was read for membership and turned over to the board of managers, Edward J. Burke, 39 Dakota St., Dorchester, Mass.

Three applications were read for the second time and approved by the board of managers and elected to membership as follows; John E. Alyward, 10 Church St. ,N. Walpole, N. H. Assoc., Charles H. Becker, 192 Highland St., Roxbury, Mass. Assoc., and Charles W. Lowell, 56 Boston St., Somerville, Mass. Assoc.

Bert Sage read his report on the Research committee meeting held at Washington, D. C. and was a very interesting one and a vote of thanks was given him for the interest he has taken in this great work. He also read the report of the last convention.

A report was made on the coming banquet to be held on Saturday, Feb. 26, 1938, at the Bradford Hotel, Boston. Arrangements have been made to hold our annual banquet in the great ball room that will hold fifteen hundred people with plenty of room. We have arranged a floor show that will be better than the last one, our technical session will be of the best speakers in the country so that the committee asks you to keep this date open and watch Boston branch go places. You can make reservations by writing the secretary A. W. Garrett, 100 King St., Dorchester, Mass.

A motion was made that the branch hold a stag party, Dec. 16th at the Manger Hotel. This will be free to the members but if you bring a friend you will have to pay for him.

This being Old Timers nite the chair was turned over to our librarian. He presented our first Pres. Francis Mackie and he was in good form. He told of his time of plating and how they had to make all their own chemicals for their solutions and that he never served his time as apprentice but made a study of chemistry and then became a plater and he is a plater that will help anyone that has a problem that they can't solve. He was given a rising vote of thanks for his very interesting talk. Our Pres. Arthur Mintie was the next speaker and he told of his time spent in the plating game working with his father in Connecticut and how he used to make the carbonate of copper and zinc and that the platers of those days had to get up at 5 A. M. to get the tin solutions working and put the work in them, go to breakfast and when they got back take the work out and put in

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another load, turning out tons of tin work in a day. He was given a rising vote of thanks for his interesting talk. They answered all questions for the members and their friends.

The meeting adjourned at 10.30 P. M.

A. W. GARRETT, *Sec.*

It is sometimes required to nickel plate over stainless steel, either bright or dull.

a. What are the opinions of platers regarding the need or advisability of plating over stainless steel when equal color matching and protection could be obtained on plain carbon steel?

b. What is a good procedure to follow in barrel nickel plating over small stainless steel articles?

STANLEY S. KNIGHT
Boston Branch

SPRINGFIELD BRANCH

The regular monthly meeting of the Springfield Branch A.E.S., was held Monday evening, October 25, 1937, at the Indian Social Club, with President Barrus in the chair.

There were thirty members present, including visiting members from the New Haven and Newark Branches.

The minutes of the previous meeting were read and approved.

The report of the banquet committee was read by Mr. Heartshorn, who is to serve as secretary of the committee. Several copies of this report were given out to the members. After some discussion, it was voted that this committee should proceed with all details and arrangements for the educational session and banquet.

Communications from the Waterbury and Detroit Branches, announcing their coming educational sessions and banquets, were read.

Mr. Bernard Caplan of London, England, and Mr. J. A. Morin of Willimansett, were elected active members.

Mr. Prouty, the librarian, then introduced Mr. T. H. Chamberlain of the New Haven Clock Company. His subject was, "The value of a platers' class for analysis of solutions." He also included in his talk some information of what was taking place at the research department of the United States Bureau of Standards. Mr. Joseph Downes, of Middletown, Connecticut, Mr. Robert Mooney of New Haven, and Mr. Edward Gann of Newark, N. J., also gave brief talks.

They were given a vote of thanks, after which, the meeting adjourned at 10:00 P. M.

HENRY R. DELARM, *Sec.*

HARTFORD BRANCH

The Hartford Branch of the A. E. S. held its regular monthly meeting on Monday evening, Oct. 25, 1937, at the State Trade School, 110 Washington St., Hartford, Conn.

The meeting was called to order at 8:15 p.m. with President Pietro in the chair. Minutes of the previous meeting were read and accepted. All communications were read and placed on file. No bills were presented. One active member, Mr. J. C. Goddard, was granted a transfer to the New Haven Branch.

We had with us, as guest speaker for the evening, Mr. Walter Meyer, of the General Electric of Bridgeport, Conn., who spoke on "Trouble Shooting in Electroplating." His talk was accompanied by lantern slides and was very interesting as well as instructive. The discussion which followed, was

quite lengthy and even more interesting. In conclusion, Mr. Meyer was given a rising vote of thanks for his very fine talk.

The meeting was attended by forty members and visitors and was adjourned at 10:45 p.m.

VERNON E. GRANT, *Sec.*

PROVIDENCE-ATTLEBORO BRANCH

The Providence-Attleboro Branch held its regular meeting, October 15, at the Narragansett Hotel. Mr. Mark Weisberg was the speaker. Mr. Chace, on opening the meeting, requested Mr. Weisberg to describe the current types, and the construction of moulds for die-casting; also the procedure in cadmium-plating on stainless-steel wire. Mr. Weisberg reviewed these two topics briefly and then took up the topic of the evening: "Immersion-Plating."

As this is a branch of the trade that his laboratory has spent a lot of time and research on, his talk was well worth hearing. Mr. Weisberg reviewed a number of the formulas of Immersion Baths that had been tried out at his plant; some of them were found to be good, and others were not practical. Refering to a chart of the electro-motive series table, values for molar solutions, he explained how the law works and then said that: you can upset the laws to your heart's content, simply by changing conditions.

Referring to his laboratory notebook, Mr. Weisberg said that there is no easy way; everything must be tried and checked. Taking the cadmium immersion bath for example, he said that contrary to the general belief that a durable deposit could not be had, they had developed a bath that would give a durable plate. The important points to be watched are: The temperature, the 0/0 of cyanide, caustic potash or soda, di Phosphate of soda. Cleaning is also very important.

There were eleven present.

The application of E.C. Tapner was received.

Mr. K. Shumpelt, of the Baker Co., will be the speaker at the next meeting.

J. ANDREWS, *Sec.*

BOSTON BRANCH

Boston Branch met Thursday, the 4th, with Pres. Mintie in the chair.

Minutes of the previous meeting read and approved. Communications read and placed on file, bills read and ordered paid.

One application was read for the second time and elected to membership: Edward J. Burke, 39 Dakota St., Dorchester, Mass.

Two applications were read for the first time and turned over to the board of managers, Joseph P. Laskey, 39 Foster St., Haverhill, Mass., and Joseph T. Montgomery, 24 Dana Ave., Somerville, Mass.

The banquet committee are working hard and will begin to show results soon.

The resignation of Alfred P. Williams of 363 Cresent St., Waltham, Mass. He was a member of Boston Branch for sixteen years, being transferred from

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New York Branch. He was with the Waltham Watch Co., for fifty years.

The chair was then turned over to our librarian, Bert Sage. He had as the speaker, Mr. Walter Meyer of the General Electric Co., of Bridgeport, Ct. The subject of his talk was "Trouble Shooting in the Plating Room." His talk was one of the most interesting the branch has had in a long time. He spoke of plating die castings, nickel and copper and showed slides of all these on the screen. He was given a rising vote of thanks after answering all questions for the members. After the meeting he was held by the members who asked more questions until his train time.

The meeting adjourned at 11 p. m.

A.W. GARRETT, *Sec.*

DETROIT BRANCH

Regular meeting of Detroit Branch of American Electro-Platers' Society was held at Hotel Statler Friday evening, November 5th, with a good attendance and Mr. A. B. Wilson in the chair. The minutes of the previous meeting were read and approved. A letter from Mr. Vincent Sheehan regarding Branch paper for the Convention in Milwaukee in 1938, was read and placed on file. There was one application for membership which the Board of Managers had approved and he was elected to active membership. The new member is Mr. Wm. E. Jenks of Eaton Mfg. Co., 2300 Leroy Street. Jackson, Michigan. There was one application for membership referred to the Board of Managers for action and report at our next meeting. LaMaine Rutherford, 148 Chandler Street, Adrian, Michigan, made application for active membership. Thomas Raymond Gill, associate member, was transferred to the Binghamton-Elmira Branch and Mr. G. W. Collins, active member, was suspended on account of non-payment of dues.

The meeting was then turned over to the speaker of the event, Mr. Vincent Mattacotti of the Hanson-VanWinkle-Munning Company, who gave quite a talk on zinc plating in general. It was very interesting and the questions asked and the discussion which took place showed that it was very beneficial to all.

After discussion on this paper Mr. W. W. McCord gave quite a talk on the coming event of our educational session, dinner and dance which will be held in the Hotel Statler, December 4th. He showed that the Committee was doing wonderful work and that we expect to have the best educational session and dance that Detroit Branch has ever held. He also impressed upon everyone present to make it a point to advertise the educational session very strongly to the works managers, superintendents and others who are not directly interested in the plating industry but who should attend this meeting. There will be no tickets required for admission to the educational session and everybody is invited and the program is one which will be par excellent.

Mr. Hoeffer of the A. T. Wagner Company who is chairman of the Branch paper committee for the Convention which will be held in Milwaukee then made a report on the activities of this committee. They are going at it in the right way and Detroit Branch may feel that it will be able to be proud of the paper which they will prepare for this Convention.

Mr. B. F. Lewis, our acting librarian, then picked up the questions and there were quite a few questions (*which I trust will be published in this issue of the* REVIEW) The Question Box is quite a feature and one of its principles is to

create interest and, by the number of questions and the discussion brought out, everyone was well satisfied that Detroit Branch is really awakening to the idea of the Question Box.

Mr. T. C. Eichstaedt of the new membership committee made a few remarks and exhorted the members to do better in the future or Detroit Branch would lose its standing as being the greatest of the Society in securing new members.

As the next meeting night should be December 3rd, we are not going to have a meeting on account of the next day being the date of our educational session. The speaker, Mr. Oplinger, who was slated to speak to us at this meeting, will be on the program of the educational session.

There being no further business, the meeting adjourned at 11 P. M.

T. C. EICHSTAEDT, *Sec.-Treas.*

BALTIMORE-WASHINGTON BRANCH

At the meeting of October 2, we had a splendid talk by Dr. Charles Kasper. The topic of his talk was "SOME ASPECTS OF POTENTIAL THEORY AS APPLIED TO ELECTRODEPOSITION"

At our meeting Saturday we had a round table discussion on PRACTICAL PROBLEMS OF CHROMIUM PLATING. Mr. Armand Tschantre acted as spokesman. Mr. S. R. Warnock enumerated his experiences, and Mr. C. T. Thomas told of his method and experiences, which were followed up by questions from those present, and brought about a number of beneficial discussions.

We had quite a large attendance and have aroused quite a bit of enthusiasm in our branch. IRVIN H. HAHN, *Sec.*

EDUCATIONAL SESSION and INFORMAL DINNER-DANCE

On Saturday, December 4th, 1937, the Detroit Branch will put on its first annual educational session and informal dinner-dance. The educational session will begin at 1 P. M. The speakers will be:

a. DR. WILLIAM BLUM, Chemist, National Bureau of Standards, Washington, D. C.
Subject: "The Value of Electroplating Researches to the Manufacturing Industry"

b. GEORGE A. HOGABOOM, Hanson-Van Winkle-Munning Co., Matawan, New Jersey.
Subject: "The Value of Thickness of Electro-deposited Coatings"

c. PROFESSOR EDWIN M. BAKER, Dept. of Chemical Engineering, University of Mich., Ann Arbor, Mich.
Subject: "Preparation or Cleaning of Metals Prior to Plating"

d. FLOYD F. OPLINGER, The R. & H. Chemical Dept., E. I. du Pont de Nemours and Company, Niagara Falls, New York.
Subject: "Practical Methods for the Disposal of Alkali and Metal Cyanide Solutions"

The dinner will be at 7 P. M. and during the dinner there will be music and a floor show. After the dinner there will will be dancing to 1:30 A. M. The tickets are $3.00 per person.

Membership Report

To November 1, 1937

ELECTIONS

Edward J. Burke, 39 Dakota St., Dorchester, Mass.
Active, Boston Branch

G. J. Yochim, 1910 Maypole Ave., Chicago, Ill.
Associate, Chicago Branch

C. L. Shaffer, 1710 Frances Ave., Elkhart, Ind.
Associate, Chicago Branch

E. J. Burke, 2145 N. California Ave., Chicago, Ill.
Active, Chicago Branch

Joseph Angaran, 4409 Vermont, Detroit, Mich.
Active, Detroit Branch

Donald A. Gifford, c/o A. T. Wagner Co., 2700 Wight St., Detroit, Mich. Associate, Detroit Branch

Donald A. P. Gaines, 1936 W. Lafayette Blvd., Detroit, Mich.
Associate, Detroit Branch

Ralph Roetter, Dresden Hotel, Flint, Mich.
Active, Detroit Branch

John F. Siefen, 1936 W. Lafayette Blvd., Detroit, Mich.
Associate, Detroit Branch

W. L. Higgs, King Seeley Corp., Ann Arbor, Mich.
Active, Detroit Branch

Clayton Beemer, West Leonard Road, R.R. No. 2, Grand Rapids, Mich. Active, Grand Rapids Branch

John Aylward, 10 Church St., North Walpole, N. H.
Associate, Boston Branch

Charles H. Becker, 192 Highland St., Roxbury, Mass.
Associate, Boston Branch

Charles W. Lowell, 56 Boston St., Somerville, Mass.
Associate, Boston Branch

John S. Dinone, Hatboro, Penna.
Associate, Philadelphia Branch

D. Woodward Prichard, Penna. Salt Mfg. Co., 1000 Widener Bldg., Philadelphia, Pa. Philadelphia Branch

James H. Robins, 618 Hazelhurst Ave., Merion, Pa.
Associate, Philadelphia Branch

H. P. Jacques, 301 W. State St., Trenton, N. J.
Associate, Philadelphia Branch

Theodore D. Gaul, 1833 Cotton St., Reading, Pa.
Active, Philadelphia Branch

Frank Waver, 1719 Cotton St., Reading, Pa.
Active, Philadelphia Branch

Raymond C. Eckert, 612 E. Brill St., Philadelphia, Pa.
Active, Philadelphia Branch

Bernard Caplan, 5 Coniston Road, Bromley, Kensington, England
Active, Springfield Branch

J. A. Morin, 50 Beverley, Willimansett, Mass.
Active, Springfield Branch

Ervin E. Frauenhoff, 242 E. 79 St., Los Angeles, Calif.
Associate, Los Angeles Branch

John O. White, 46 Kellogg St., Waterbury, Conn.
Associate, New Haven Branch

Cortlandt Heyneger, 65 Pine St., Waterbury, Conn.
Associate, New Haven Branch

Clinton S. Goodwin, P. O. Box 16, Kensington, Conn.
Associate, New Haven Branch

Carl S. Johnson, 1744 Main St., Stratford, Conn.
Associate, New Haven Branch

Frank J. Martin, 202 Wood St., Waterbury, Conn.
Associate, New Haven Branch

Albert Jagun, 12 Clifton, St., Seymour, Conn.
Active, New Haven Branch

George C. Gerner, The Miller Co., 99 Center St., Meriden, Conn.
Associate, New Haven Branch

Sidney Helliwell, C. W. Haynes Laboratory, Springfield, Mass.
Associate, New Haven Branch

Carmine Matteo, 35 Broad St., Plainville, Conn.
Associate, New Haven Branch

Charles J. Koelbl, 181 Main St., New Haven, Conn.
Active, New Haven Branch

Anthony Saracco, 69 Whiting St., Hamden, Conn.
Active, New Haven Branch

Norman H. Eddy, Quist Mfg. Co., Blake St., New Haven, Conn.
Active, New Haven Branch

Joseph A. Barratt, 220 North St., Nichols, Bridgeport, Conn.
Active, New Haven Branch

Clarence Garner, 191 So. Whittlesey Ave., Wallingford, Conn.
Active, New Haven Branch

David Gordon, 11 Church St., Dartmouth, N. S.
Active, Toronto Branch

James Brady, 1413 Davenport Ave., Toronto, Ont.
Active, Toronto Branch

William E. Jenks, Eaton Manufacturing Co., 2300 Leroy St., Jackson, Michigan. Active, Detroit Branch

APPLICATIONS

W. A. Burke, 2707 - 74 Court, Elmwood Park, Ill.
Associate, Chicago Branch

J. E. Morgan, 1542 N. Kedzie Ave., Chicago, Ill.
Active, Chicago Branch

Lester Detre, Brainerd Steel Corp., Warren, Ohio.
Cleveland Branch

A. L. Spiser, Republic Steel Corp., Cleveland, Ohio.
Cleveland Branch

Benson Lister, 84 Lester Ave., Newark, N. J.
Associate, Newark Branch

John R. Gumm, 71 38th St., Irvington, N. J.
Associate, Newark Branch

Joe Boughner, 1921 W. Kilbourn Ave., Milwaukee, Wis.
Active, Milwaukee Branch

Alton E. Tapner, Saylesville, R. I.
Associate, Providence-Attleboro Branch

SUSPENSIONS

G. Barnes, 517 Westmount Ave., Toronto, Ont.
Toronto Branch

J. W. Berenato, 1135 S. Ruby St., Philadelphia, Pa.
Active, Philadelphia Branch

R. E. Harrison, Willard & Collins Sts., Philadelphia, Pa.
Associate, Philadelphia Branch

H. C. Brubaker, 24 Mary St., Lancaster, Pa.
Active, Philadelphia Branch

Melvin Lutzke, 2795 So. Ellen St., Milwaukee, Wis.
Associate, Milwaukee Branch

J. H. Johnson, Box 261, Trenton, Ontario Toronto Branch

Wm. Stone, Box 251, Whitby, Ontario Toronto Branch

J. Welsby, 75 Graham Ave., S. Hamilton, Ontario
Toronto Branch

Francis J. Brennan, 24 Warwick Rd., Watertown, Mass.
Boston Branch

J. Arthur Zimmer, 149 W. Sixth St., So. Boston, Mass.
Boston Branch

Ernest C. Andrews, 148 Wordworth St., E. Boston, Mass.
Boston Branch

James J. Reagan, 213 Princeton St., E. Boston, Mass.
Boston Branch

Charles A. Sleicher, 43 Oak Ave., Larchmont, N. Y.
Boston Branch

DECEASED

H. A. Haisman, 1917 Grove Ave., Berwyn, Ill.
Chicago Branch

Harry Marmer, 1906 W. 41st Place, Los Angeles, Calif.
Los Angeles Branch

Membership Campaign

November 1, 1937

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Milwaukee	8	
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Waterbury	4	
Springfield	4	
Toronto	4	
Toledo	3	
Bridgeport	3	
Binghamton-Elmira	2	
Los Angeles	2	
Providence-Attleboro	2	
Cleveland	1	
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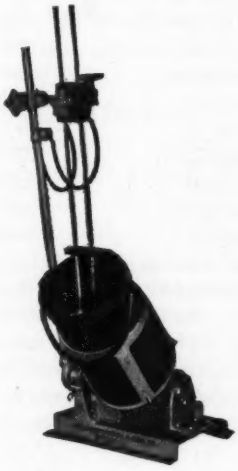

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The Abstract Section

R. M. GOODSELL, *Chairman, Program and Educational Committee*

The Thickness of the Electroplated Coatings and Methods for its Measurement. E. MILLS and E. C. J. MARCH. *Engineering* (England) **144,** 53, 1937—Examples are given of the variations in thickness of coatings plated on articles in different positions in both still tanks and conveyor tanks. Recommended thicknesses of coating for indoor installation are as follows:

Coating	*Base Metal*	*Service*	*Average Thickness, In.*
Zinc	Ferrous	Temperate	0.0004
		Tropical	.0008
Cadmium	Ferrous	Both	.0003
Nickel	Ferrous	Temperate	.0007
		Tropical	.0014
Nickel	Brass, Copper,	Temperate	.00035
	or Bronze	Tropical	.0007

For outdoor exposure, hot dipped or sprayed metal coatings are recommended. Recommended methods for measurement include the following: (1) Especially for screw threads, the profile of the article, in a fixed position, either before and after plating or before and after stripping, is projected on a screen at a definite magnification. (2) Microscopic cross sections by the usual method. (3) Average thickness by stripping. (4) Dropping tests such as the iodine solution for cadmium as described by S. G. Clarke. W. BLUM.

The Electrodeposition of Tin Acid Sulphate Solutions. A. W. HOTHERSALL and W. N. BRADSHAW. *Jour. Electrodepositors' Tech. Soc.*, **12,** preprint, April 7, 1937—Acid tin solutions, in which the valence of tin is 2, yield, at the same efficiency, twice as much tin as the alkaline stannate solutions, in which tin has a valence of 4. The anode and cathode efficiencies are nearly 100 percent in the acid baths. The latter, however, have poorer covering power and are less stable. The purpose of this investigation was to remove these drawbacks. It was found that addition agents are required to produce good covering, and stabilizing agents to retard decomposition of the bath. The following solution is recommended:

	g/l	*oz/U.S. gal*
Tin (introduced anodically)	30	4
Free sulphuric acid	50-100	7-13
Cresol sulphonic acid	100	13
Gelatin or	2	0.27
Lysalbic acid (from egg albumen)	1	0.13
Beta naphthol or	1	0.13
Resorcinol	20	2.7

This solution is used at room temperature with 15 to 20 amp/ft^2 in still baths, or 60 to 80 amp/ft^2 in well agitated baths. W. BLUM.

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Drop Test for Measuring the Thickness of Nickel Electrodeposits. M. BALLAY. *Jour. Electrodepositors' Tech. Soc.*, **14,** preprint, Sept, 22. 1937—A drop test for nickel coatings that has been used for several years by the French railways, uses the following reagent

Conc. Nitric acid	80 ml
Conc. Sulphuric acid	20 ml
Water	40 ml

One drop of this solution is applied to the cleaned nickel surface and allowed to react for exactly 1 minute. It is then wiped off, and the surface examined to see if the base metal (or intermediate layer of copper) is exposed. If not, a second drop is applied for 1 minute, and so on, till the nickel is penetrated. The minimum thickness is specified in terms of the number of 1 minute treatments the coating must withstand.

From numerous tests on both plated coatings and on rolled nickel foil, it was found that:

(1) The rate of solution for different nickel deposits is about the same, unless the coatings are very porous, in which case they dissolve more rapidly. Rolled nickel dissolves somewhat more rapidly than electrodeposited nickel.

(2) A variation of only 5 percent in the concentration of the reagent produces a change of about 30 percent in the rate. No water should therefore be present in the dropper, and after each treatment the acid should be wiped off of the spot and not washed off. The solution should be aged at least 24 hours, and not used after 3 months.

(3) The effect of temperature is very marked, so the solution and specimen must be at the same temperature, for which the appropriate factor should be used. The tests should all be made between 15° and 25° C (60 and 77° F). Typical rates for electrolytic nickel are:

	18.5°C (65°F)	22.5°C (73°F)
Rate x 0.001 mm per minute	1.64	1.94
Rate x 0.00001 inch per minute	6.6	7.8

If, for example, a coating withstands 5 one-minute dips at 65° F, it is 5 x 6.6 = 33 hundred thousandths (0.00033) inch thick. W. BLUM.

The Removal of Electrodeposits of Nickel from Steel. G. E. Gardam. *Jour. Electrodepositors' Tech. Soc.* **14,** preprint, Sept. 22, 1937—Nickel is removed from steel for re-plating by reverse current in sulphuric acid, 50 percent by volume (64 percent by weight) with a potential of not more than 2.0 volts. The solution should not be stirred during the stripping. For quantitative stripping for determination of the nickel, acid 55 percent by volume (70 percent by weight) should be used. The error is then equivalent to about 0.00004 inch (which is 4 percent on a coating 0.001 inch thick.

W. BLUM.

Health Risks in the Finishing Trades. E. R. A. MEREWETHER. *Jour. Electrodepositors' Tech. Soc.* **12,** preprint, April 6, 1937—Hazards are briefly summarized under the headings: electrical, fire and explosion; dusts; solvents; acids, alkalies and other liquids; and fumes; and preventive measures.

W. BLUM.

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Effect of Pickling on Mechanical Properties of Steel—KOSUKE KIKUCHI (Japan Steel Tube) "*Tetsu-to-Hagane*" Vol. **23,** Apr. 25, 1937 pp. 348-353—*Original Research.* The change in tensile strength and elongation of low carbon steel tubes, small in diameter, which were pickled in acid solutions of various concentrations and at different temperatures, was determined. The results are summarized as follows: (1) Steels pickled in acid solution show an increase in tensile strength and a decrease in elongation (2) Acid brittleness in pickled steel can, to a certain extent, be prevented by the use of some inhibitors (3) Acid brittleness is eliminated by heating the pickled steel at a relatively low temperature or by holding at room temperature for several days.

PHIL. J. RITZENTHALER

High Speed and Close Control Feature New Lines for Cleaning—M. STONE (United Eng. & Foundry Co.) "*Steel*" Vol. **100,** June, 1937 p. 54-56. Article describes commercial use of an electrolytic cleaning line for removal of oil from cold-rolled strip at speeds in excess of 900 ft./min. Comprises an uncoiler, seam type electric welder for joining ends of coils, power washer for removing major portion of coil by high pressure, sprays of hot cleaning solution, rotary scrubbing brushes, electrolytic tank in which work is cathode with anodes and wringer rolls for drying strip. Material is pulled through line against a controlled back tension by a set of pinch rolls ahead of wringer rolls.

PHIL. J. RITZENTHALER

Permanent Colors Produced Electrolytically on Metal Surfaces without Aid of Pigments—"*Steel*" Vol. **100,** March 22, 1937 pp. 56-57—Practical Description of Patented Process—JESSE E. STARECK—Brit. Patent 452, 464,—(U. S. Patent 2,059,053). Metal article is made cathode in an alkaline electroplating bath which produces a thin film which shows in succession different interference colors with increasing film thickness. Desired color is obtained by stopping at correct film thickness. On plated copper, colors are produced directly from bath, but with plated iron, copper, or nickel, subsequent baking operation is required to bring out color.

PHIL. J. RITZENTHALER

Compressed Air Burnishing Material Loader—H. LEROY BEAVER, "*Product Finishing,*" Oct. 1937 pp. 56-61—Describes method of using compressed air for reloading burnishing balls back into barrel after burnishing, Consists of correctly tilled drainage and unloading pan underneath the barrel. two drain pipes with proper screens so balls are separated from work and can enter reloading chamber. Loading section is made up of three sections of straight pipe and three bends that can be joined together. Compressed air above 50 lb. sq. in. pressure then returns balls up pipe to barrel. Author claims less spillage, less labor, and saving of soap.

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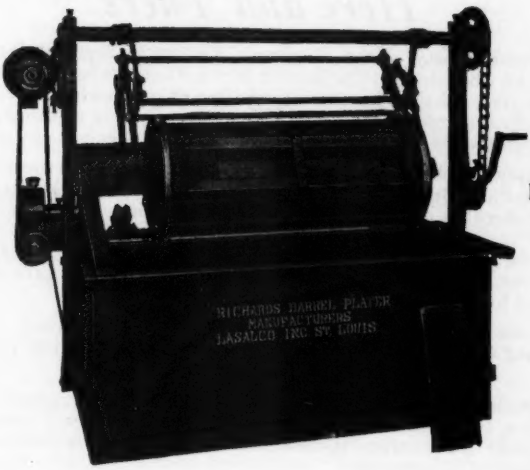

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Here and There

The November issue of the MONTHLY REVIEW is dedicated to Research Reports of the work done at the Bureau of Standards as read at the New York Convention are published for the information of our readers. A summary of the business transacted at the recent research committee meeting in Washington is also included.

On Saturday October 23rd a meeting of those interested in forming a Branch of the A. E. S. in Buffalo was held at the Stratford Arms Hotel. Mr. Wm. Hart active member of Rochester Branch was unanimously asked to preside. After a few remarks Mr. Hart introduced the Executive Secretary, who explained the steps necessary to be taken in the petition for a temporary charter Past President, E. Steen Thompson came over from Erie and gave the members the benefit of his experience as a member of the A. E. S.

Mr. Warren Guy and Mr. Joseph Ruff also active members of Rochester Branch spoke enthusiastically regarding the prospects of the proposed new Branch.

At the conclusion of the meeting it was voted by those present to petition the Executive Board for a temporary charter. Rochester Branch suggested that they would like to attend the first meeting and help instal the new officers, when the charter is received.

On Saturday, Nov. 6, Waterbury Branch completed the plans made last winter for its first Annual Educational Session and Banquet. George B. Hogaboom presided. President Tennant Elwin, and the members of the committee deserve great credit for the success of the affair which was well attended.

Walter Meyer spoke on his recent trip to Europe and told of plating practice over there. J. E. Charleson, Yale & Towne Mfg. Co., gave a splendid practical talk on the Finishing of die Castings.

Dr. Charles Edlin, M. D., gave a novel and very instructive address on Electro-Chemistry as applied to medicine, demonstrating the value of the galvanic battery.

Over 150 members, their wives and friends from out of town sat down to the banquet.

Horace Smith, Past President of the National organization attended and is very enthusiastic regarding Newark's 1939 convention at Asbury Park. Incidentally Mr. Hogaboom informed us, this will be the 100th anniversary of electroplating.

Door prizes were distributed to those holding the lucky numbers. Three newly married couples were among the winners both husband and wife in each case taking home the gifts, which were both handsome and useful.

Dick Crane of the Lea Co. had charge of the "mike" while the prizes were being distributed. Congratulations Dick, there's another baby in the family.

Ellsworth Candee the new Sec.-Treas of Waterbury Branch is starting his duties in fine shape. His branch reports are always interesting.

Springfield Branch Educational Session and Banquet, Sat. November 24. This is our first attempt. But you will be sorry if you miss it.

Philadelphia holds its "Annual" the same day. Best of luck to the Quaker City boys, it's too bad the dates conflict, we would like to be with you.

They're coming thick and fast, Detroit has a big event scheduled for Saturday, Dec. 4. Blum, Oplinger, Hogaboom and Baker are the speakers. Everyone knows that Detroit does things in a big way. This meeting will be no exception. Boston's annual meeting will be on February 26, 1938.

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NEW HAVEN BRANCH OF THE A. E. S.

The New Haven Branch of the A.E.S. held its first open meeting on Tuesday, November 5th at the Sterling Chemistry Laboratory of Yale University.

Dr. W. Blum of the Bureau of Standards, as guest lecturer gave a very interesting talk on "Specifications and Methods of Testing Electro-Plated Coatings." A large audience of members and friends, in number about 125 attended this lecture.

The educational committee headed by Tom Chamberlain has been very active and has outlined a program for the remainder of the year which should prove to be a corker. An open meeting will be held on the first Tuesday of every month until June, 1938. Speakers have already been signed up for each open meeting.

In addition to these guest speakers, plans are well under way for the conducting of a laboratory course for the members. This course will be held in one of the Yale Laboratories where each member will have his own apparatus, reagents, etc. The purpose of the course is to teach the members methods of solution analyses and control.

Although the New Haven Branch is indeed a true infant in the Electro-Platers Society, we feel that the enthusiasm of the members plus the fine varied program which the educational committee has outlined, will make the other branches sit up and take notice.

J. T. SULLIVAN,
Sec. Educational Committee.

The New Haven Branch of the A. E. S. held an open meeting Tuesday, Nov. 2nd at the Sterling Chemistry Laboratory of Yale University.

Dr. A. K. Graham, chemical engineer of the A. Kenneth Graham & Associates-Engineers and Consultants, Jenkintown, Penn. and former professor of chemistry at the Univ. of Penn. gave a very interesting illustrated lecture on "The Rochelle Salt Copper Plating Bath." A large turnout of some 150 members and guests were present. The meeting was conducted by Joe Sullivan, secretary of the educational committee.

The next meeting will be held Tuesday, Dec. 7th and the guest speaker will be Dr. E. Bucy of the Zapon Co., Stamford, Conn. Bob Mooney has been delegated by our chairman of the educational committee, Tom Chamberlain, to conduct this meeting. This meeting will be preceeded by a dinner at the Hotel Garde. The dinner committee consisting of Jack English, Bob Mooney, Hank Kellner, Roy Brown and Joe Sullivan has already made arrangements for this affair. A very fine menu plus some fine door prizes and an excellent dinner speaker are excellent evidence of the work of the committee.

The school in analyses of plating solutions and simple metallurgy will get underway in a few weeks under the direction of Tom Chamberlain. Yale University has kindly given us the use of one of the laboratories for this work. There will be a small registration fee to take care of cost of chemicals and breakage. Several chemists and assistant chemists, all members of the N. H. Branch will act as instructors under professor Tom Chamberlain.

J. T. Sullivan, Sec. Educ. Committee, N. H. Branch A. E. S.

CORRECTION

in Mr. Hogaboom's paper on the "pH of Alkali Plating Solutions"

(Printed in the October 1937 issue of THE MONTHLY REVIEW.)

Page 724, paragraph 1 — *line* 2, change "at room temperature" to "warm" Paragraph 3, *line* 3, change "cold" to "warm." *Line* 4, change "warm" to "cold."

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DETROIT BRANCH FIRST ANNUAL EDUCATIONAL SESSION AND INFORMAL DINNER DANCE

On Saturday, December 4th, 1937, the Detroit Branch will put on its first annual educational session and informal dinner-dance. The educational session will begin at 1 P. M. The speakers will be:

a. DR. WILLIAM BLUM, Chemist, National Bureau of Standards, Washington, D.C.
   Subject: "The Value of Electroplating Researches to the Manufacturing Industry"

b. GEORGE B. HOGABOOM, Hanson-Van Winkle-Munning Co., Matawan, New Jersey.
   Subject: "The Value of Thickness of Electro-deposited Coatings"

c. PROFESSOR EDWIN M. BAKER, Dept. of Chemical Engineering, University of Mich., Ann Arbor Mich.
   Subject: "Preparation or Cleaning of Metals Prior to Plating"

d. FLOYD F. OPLINGER, The R. & H. Chemical Dept., E.I. du Pont de Nemours and Company, Niagara Falls, New York.
   Subject: "Practical Methods for the Disposal of Alkali and Metal Cyanide Solutions"

The dinner will be at 7 P. M. and during the dinner there will be music and a floor show. After the dinner there will be dancing to 1:30 A. M. The tickets are $3.00 per person.

EXPANSION PROGRAM OF THE MAGNUSON PRODUCTS CORPORATION

Enlarged laboratory facilities have recently been completed by the Magnuson Products Corporation of Brooklyn, N. Y., manufacturers of the famous PERMAG Cleaning Compounds.

As a result of this expansion, the Magnuson Research Service will be effectively broadened and will be of more intensive value to customers as applies to working out problems in metal cleaning.

With these greater facilities, the laboratory will carry out extensive research, and there will be available such products that will enormously accelerate production in metal cleaning departments of prominent industries throughout the country. These products will tend toward both efficiency in speed and thoroughness in their work, combined with economy and low cost.

Office space has also been enlarged and there has been an addition in personnel, which has enabled the corporation to care for increased business—the quick and accurate handling of orders, and the prompt careful shipment and delivery of products.

It may be definitely stated that, due to research work now under way there will shortly be available, additional and exceptionally efficient cleaning compounds and solvents, produced to merit the highest approval of the most exacting users in the metal working industry.

PURICO WONDER BAR

Pre-Saponified Compositions for Buffing and Polishing

Satisfy the most particular users.

Ideal for use on pierced, grooved, and filigreed work because it is pre-saponified, and washes absolutely clean, faster and without scrubbing.

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A heavy duty cleaner that can be used on rough work and on the most delicate of jewelry finishes.

Not the cheapest but sold on its merits.

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The new numbers for buffing and cutting down stainless steels and other steels are going over big.
All we ask is the opportunity to serve you — the answer is then in your hands.

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Polishing and Buffing
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Our new laboratory and staff will be glad to assist you in your Polishing and Buffing problems

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"Insist on McAleer's"

DETROIT REX PRODUCTS COMPANY OCCUPIES NEW BUILDING

Construction of a large, modern manufacturing building which will provide the Detroit Rex Products Company of 13005 Hillview Avenue, Detroit, Michigan, with approximately 30,000 square feet of additional floor space has been completed by the Austin Company, Industrial Engineers and Builders.

The increased demand for solvent degreasing machines and degreasing solvents has made this expansion program necessary, according to R. A. Emmett, President. This is the second time within the period of a year that manufacturing facilities have been enlarged to meet the increased demand for this company's products.

The building is constructed of steel frame with face brick set to emphasize the horizontal detail which adds distinction to the building's modern design. At the same time, the new plant conforms in general to the present building to which it is joined by a second floor bridge. The new building is 100 ft. wide, and has a second story 40 ft deep extending across the front of the structure. Engineering offices and drafting rooms are located on the second floor; while research and physical laboratories, as well as shop offices, are located on the first floor. The plant proper has a 40 ft. center aisle, with 24 ft. clearances, in which a ten ton traveling crane operates, and two 30 ft. wide aisles each with 16 ft clearances. Two 3 ton monorails have been installed in the side aisles. The bays are 27 ft. 2 in. wide, and have been designed especially to accommodate the large degreasers now being built.

The building is entirely constructed of fire-proof materials; having a floor of steel trowelled concrete, surface with a metallic hardener, and an insulated metal roof deck which has been welded to the steel joist purlins. These are in turn welded to the structural steel frame work on the building. Walls of the structure are formed for the most part by continuous horizontal runs of steel sash.

The project includes installation of tracks along side the plant and a special railroad siding which extended through the end bay of the building.

A power plant of modern design has been incorporated in a special building adjoining the plant which has been equipped with the plant of heating, plumbing, and lighting equipment. The entire project represents an investment of approximately $100,000, exclusive of equipment.

Officers of the company are: R. A. Emmett, President; W. W. Davidson, Vice-President In Charge of Sales; C. F. Dinley, Vice-President In Charge of Research and Engineering; and G. E. Powers, Secretary Treasurer.

DETROIT REX OPENS CINCINNATI OFFICE

In line with the general expansion program recently inaugurated, the Detroit Rex Products Company of Detroit, Michigan—manufacturers of Detrex Degreasing Machines, Perm-A-Clor and Triad Solvents, and Triad Alkali Cleaners and Strippers—has opened a branch office located in the Provident Bank Bldg., at Cincinnati, Ohio.

This office will serve the lower Ohio and Indiana areas, as well as the northern section of Kentucky. A warehouse at Lockland, Ohio, will carry ample stocks of solvents, so that immediate delivery can be made to all points in this territory.

The addition of this new branch office will help to increase the scope of the personal service facilities offered by the company to its many customers in this area, and materially assist the company in maintaining its position of leadership in the industrial cleaning field.

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Let Harshaw supply you with anodes designed to meet your requirements . . . . Anodes of the type, size and shape you need for your plating operations are made in our modern foundry under strict laboratory control . . . . You can depend on uniformity and superior anode corrosion when you buy from Harshaw.

Single and double nickel salts, pure nickel chloride, light and fluffy nickel carbonate, Krome Flake (chromic acid), cadmium anodes, cadmium oxide, cadmium hydrate, cadmium salts, and anodes and chemicals for all kinds of plating.

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Offices and Laboratories: Cleveland, Ohio.
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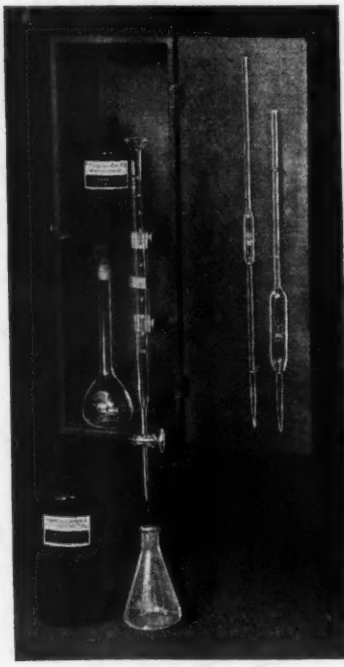
KOCOUR ANALYTICAL SETS FOR CADMIUM AND ZINC ELECTROPLATING SOLUTIONS

Determines Metal Content, Sodium Cyanide, Sodium Hydroxide, and Sodium Carbonate



The control set pictured here enables anyone to rapidly determine the condition of a cyanide cadmium or zinc solution. It is well known that maximum efficiency is obtained only when solutions are maintained at proper concentrations of the various ingredients. Such factors as the time necessary to deposit a given thickness, the current density permissable, the non-porosity of the plate, and the appearance of the deposit are all dependent upon a balanced solution.

The set is extremely easy to operate, the makers having in mind that the average user knows little or no chemistry. Directions are easily followed and the results as easily obtained. Readings obtained from the set are the results sought, there are no involved calculations required. All readings are in ounces per gallon of solution of the various ingredients. Directions also include means of altering solutions should they be out of balance.

The set, similar to the one pictured at the left, consists of a well made wall cabinet fitted with hardware to hold the necessary glassware during use and storage. The glassware is of finest make, most of it made especially for us. The solutions are in easily handled bottles, well labelled. The solutions are concentrated so that very little is used in each test. The solutions do not deteriorate with age, therefore, assuring correct results and economical operation at all times. Directions, as mentioned above, are very complete.

The set was developed, and is manufactured by Kocour Company, Chicago, specialists and pioneers in Control Sets for Plating Solutions.

NEW "SPEED" PRIMER DEVELOPED

A new synthetic primer for use on metal products that air-dries out of dust in 5 minutes and, therefore, reduces the rejects due to shop dust and dirt, has been developed by Maas and Waldstein Company, makers of industrial finishes, Newark, New Jersey.

This new "speed" primer is suitable for use under air-drying lacquer-enamels or baking synthetic enamels, or as a shop coat. It air-dries, or can be force dried or baked, giving a very flexible schedule ranging from 2 hours at 160° F to 20 minutes at 275° F. It has good adhesion, excellent building and hold-out properties and is easily sanded. It is supplied in many colors for either dipping or spraying.

The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

DECEMBER 1937

E. M. Baker ✓

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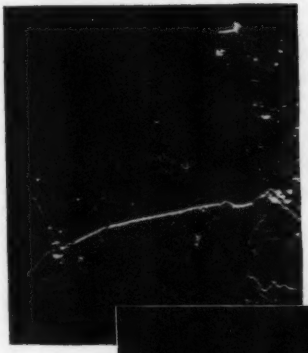

Plain Steel Base

Jetalized Steel Base

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The Jetal Process is a simple, rapid, economical way to get a superior paint base on iron and steel products.

The film obtained is hard and the most adherent available. Articles Jetalized can be stored before painting—they are easily cleaned—withstand heat and electric welding—can be "blanked" and formed without harm to the coat.

Jetal is a PAINT BASE THAT STRENGTHENS EXISTING FEATURES OF LACQUERS AND ENAMELS, AND ALLOWS THEM TO DEVELOP THEIR FULL NATURAL ATTRIBUTES OF ADHERENCE.

For a Jet Black Finish

Jetal, by the same simple, low-cost dipping operation and with the same qualities as a paint base, is an excellent process for coloring iron and steel a uniform jet black. Highly polished surfaces will take a deep brilliant lustre while dull objects will take a dull finish.

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